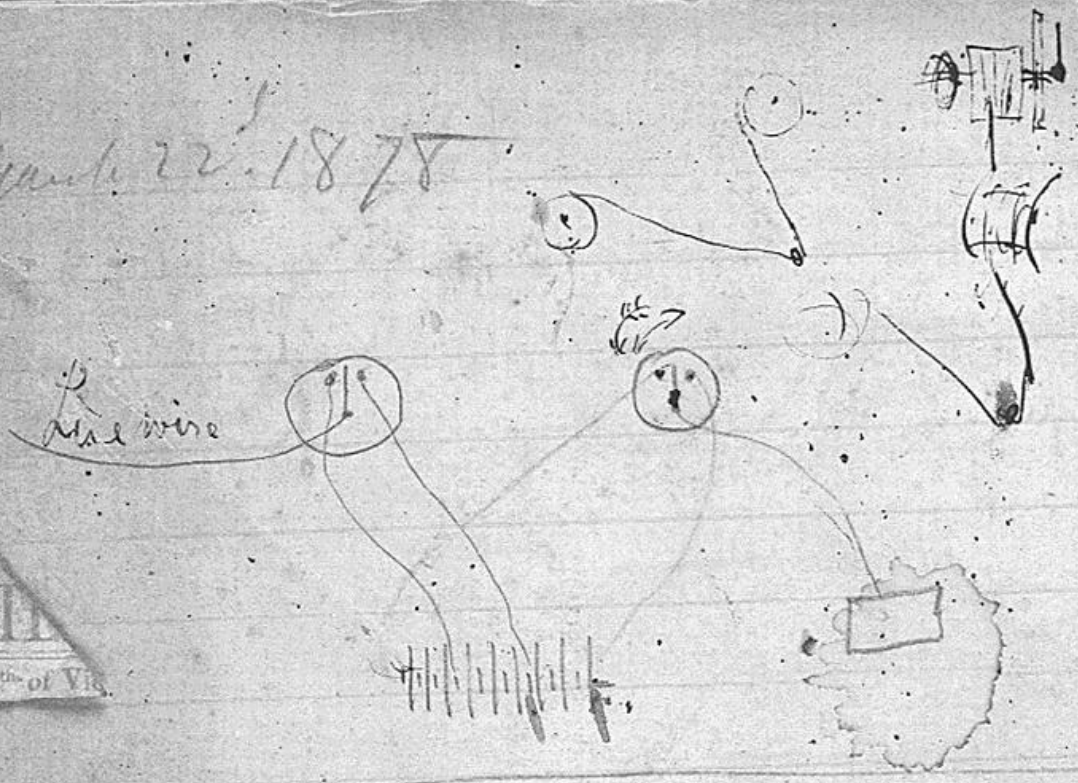
Sat Notes

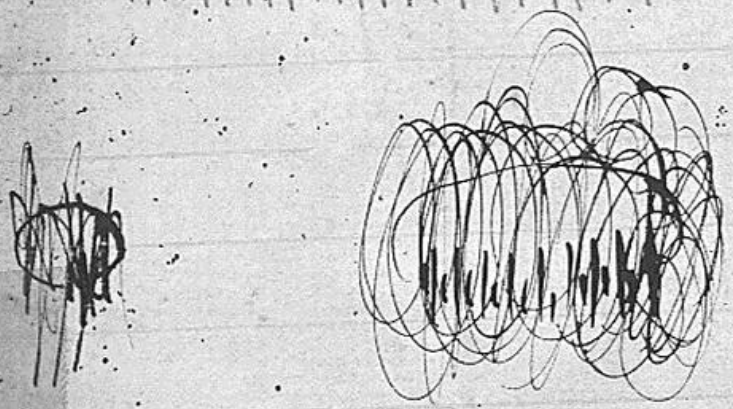
March 22, 1878

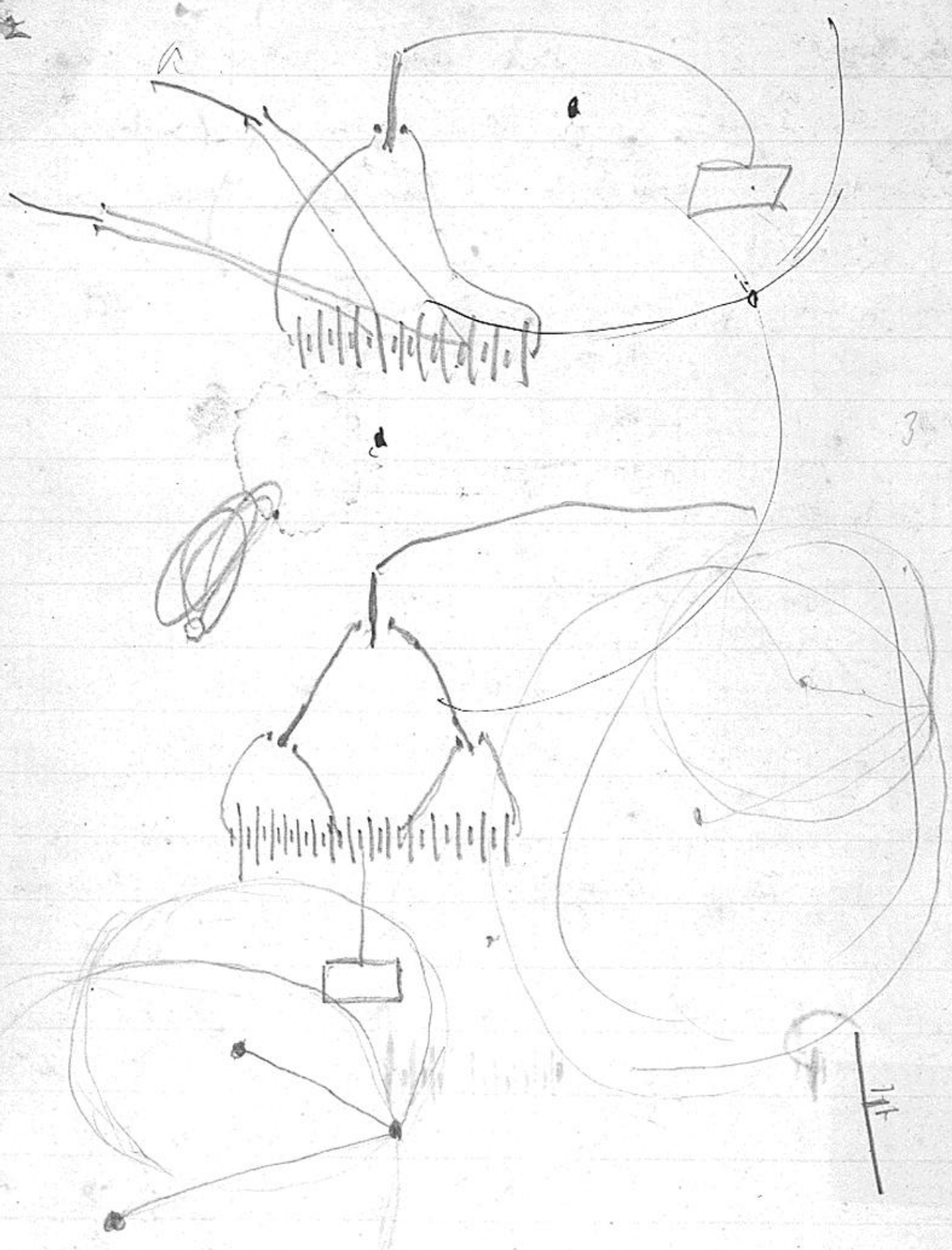
October 5, 1878

(Telephone)

March 22. 1878







March 23d 1875 New Autographic Telegr.

Principle. A point may be completely defined by its rectilinear distance from two fixed points.

Let A B be two tubes capable of free motion upon vertical axes C D. Through the tubes let rods E F pass united by a hinge at G. Let them carry at their point of junction a pencil arranged vertically on a holder. Any position of the pencil point can be determined by giving the lengths C G, D G,.

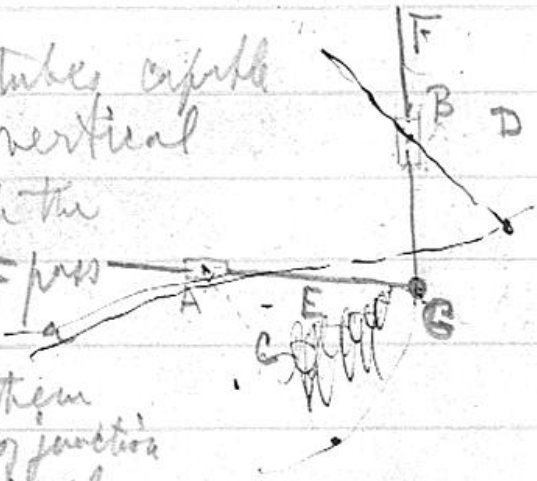


Fig 1.

Now let mechanism be arranged so that the rods E & F can be moved through their holders A & B in either direction by the action of electro-magnets. Let F be operated by positive currents of electricity & E by negative currents. Let F be pushed forwards in the direction of G when ther a strong positive impulse is received and in the opposite direction when a weak impulse is received and E be pushed forwards by strong negative current & back by weak negative. Use a rapidly alternating current and thus the point G can be caused to move into any position so as to write a sentence or draw a picture.

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At Receiving end have a polarized relay (A) arranged so as to switch off the positive currents into one set of magnets (BC) and the negative currents into another set (DE).

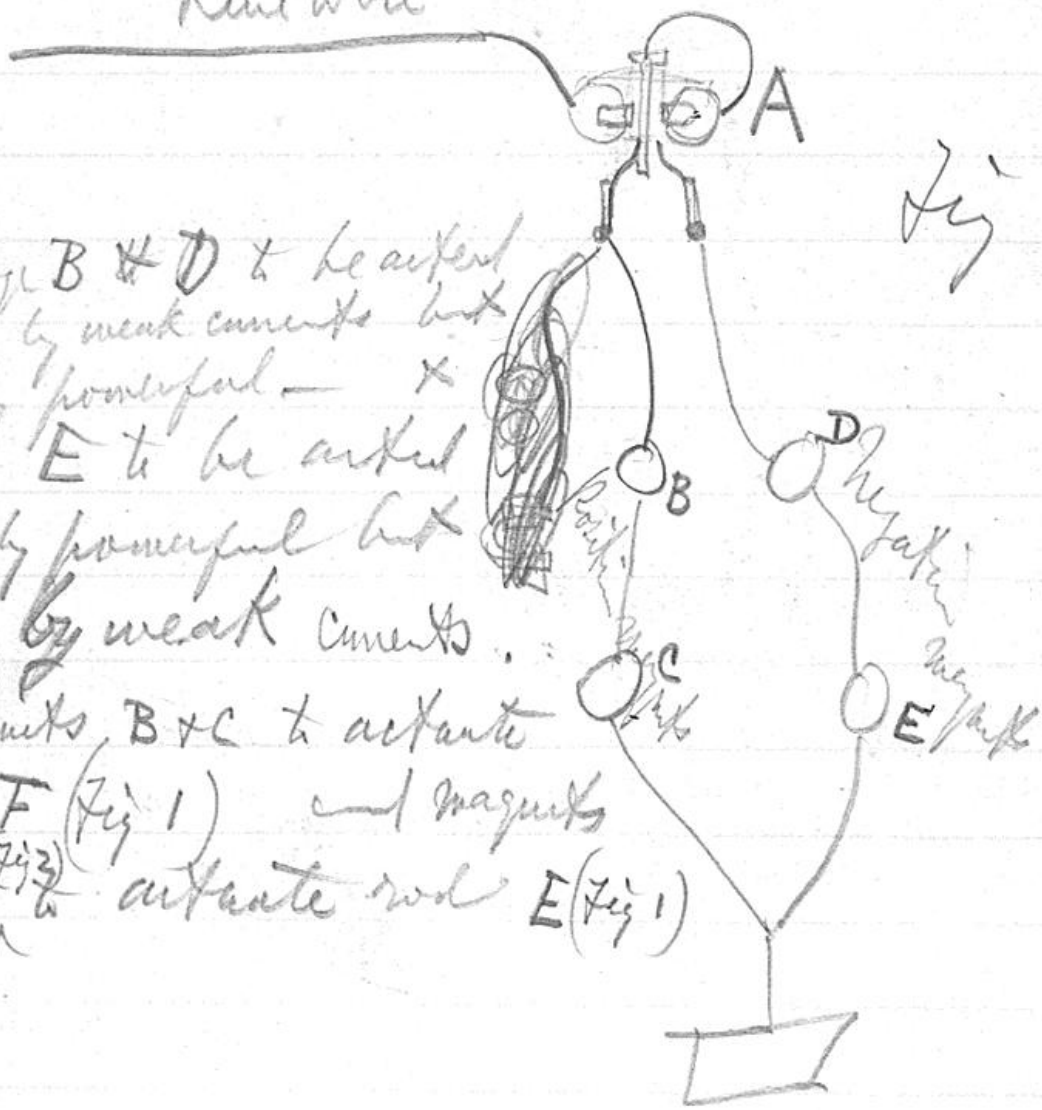


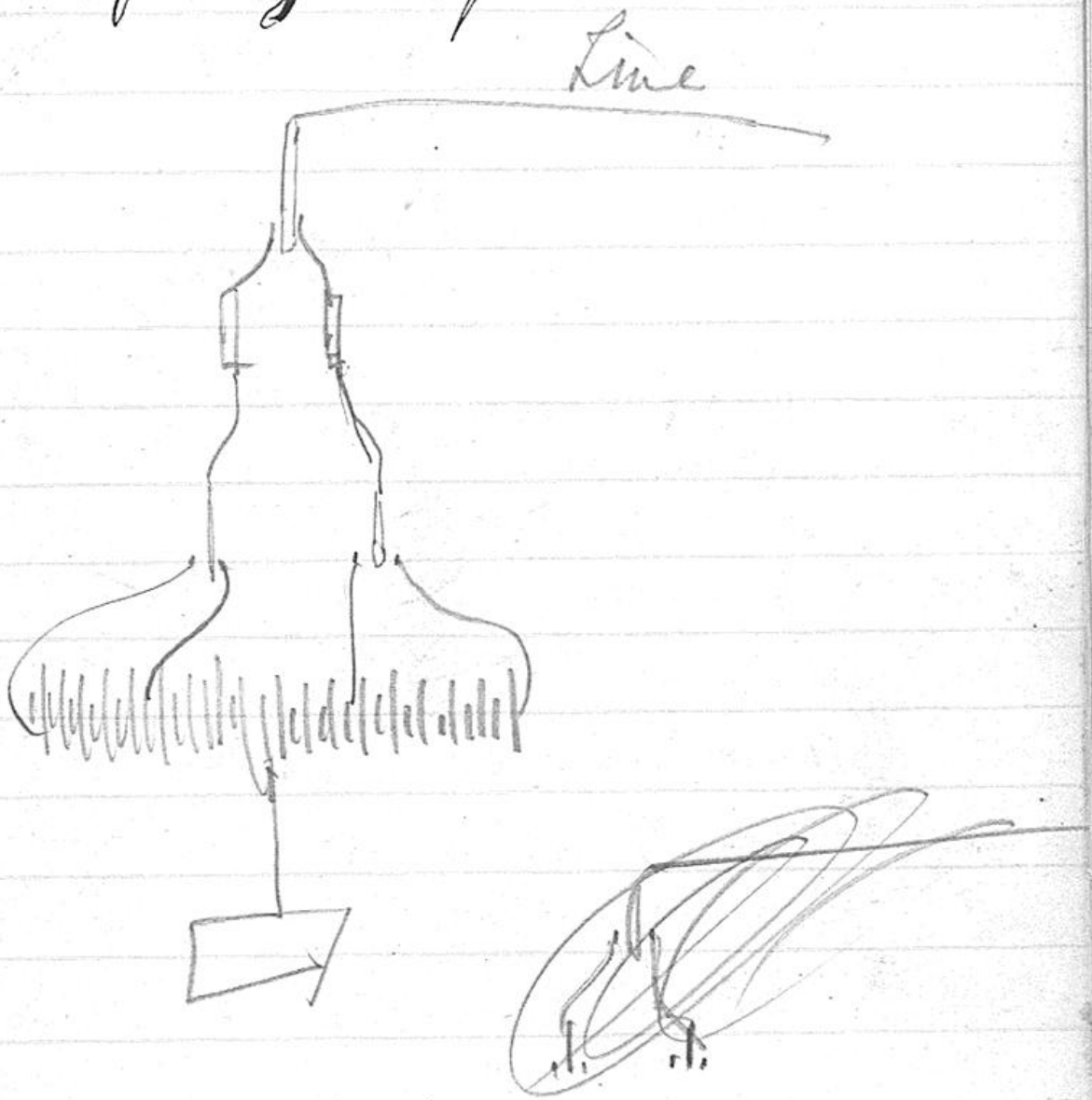
Fig 2

Armature B & D to be acted upon by weak currents but not by powerful — & C & E to be acted upon by powerful but not by weak currents.

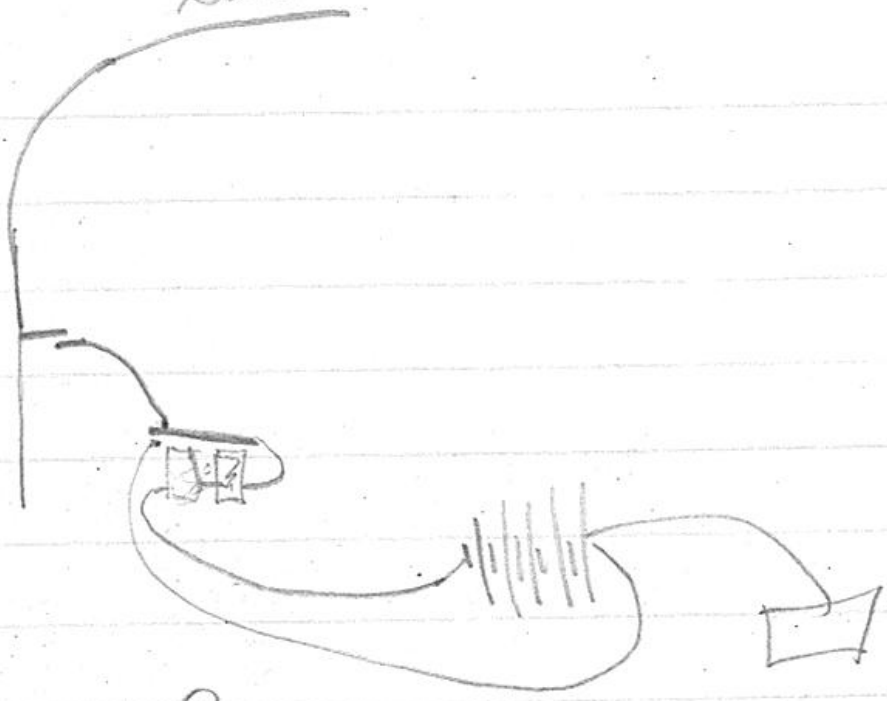
Magnets B & C to actuate rod F (Fig 1) and magnets D E (Fig 3) to actuate rod E (Fig 1)

I am perfectly sure that
this is perfectly legible in this

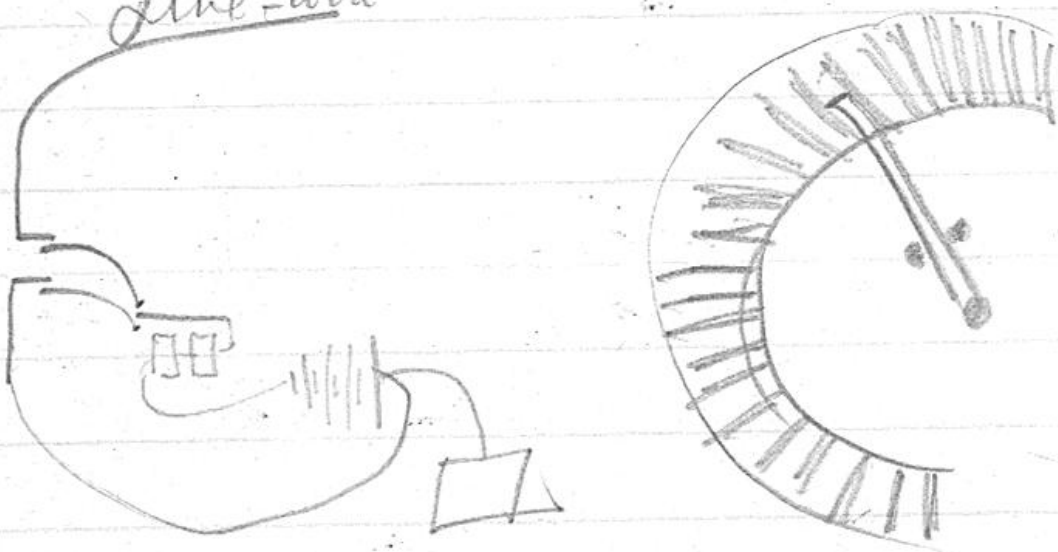
March 23d



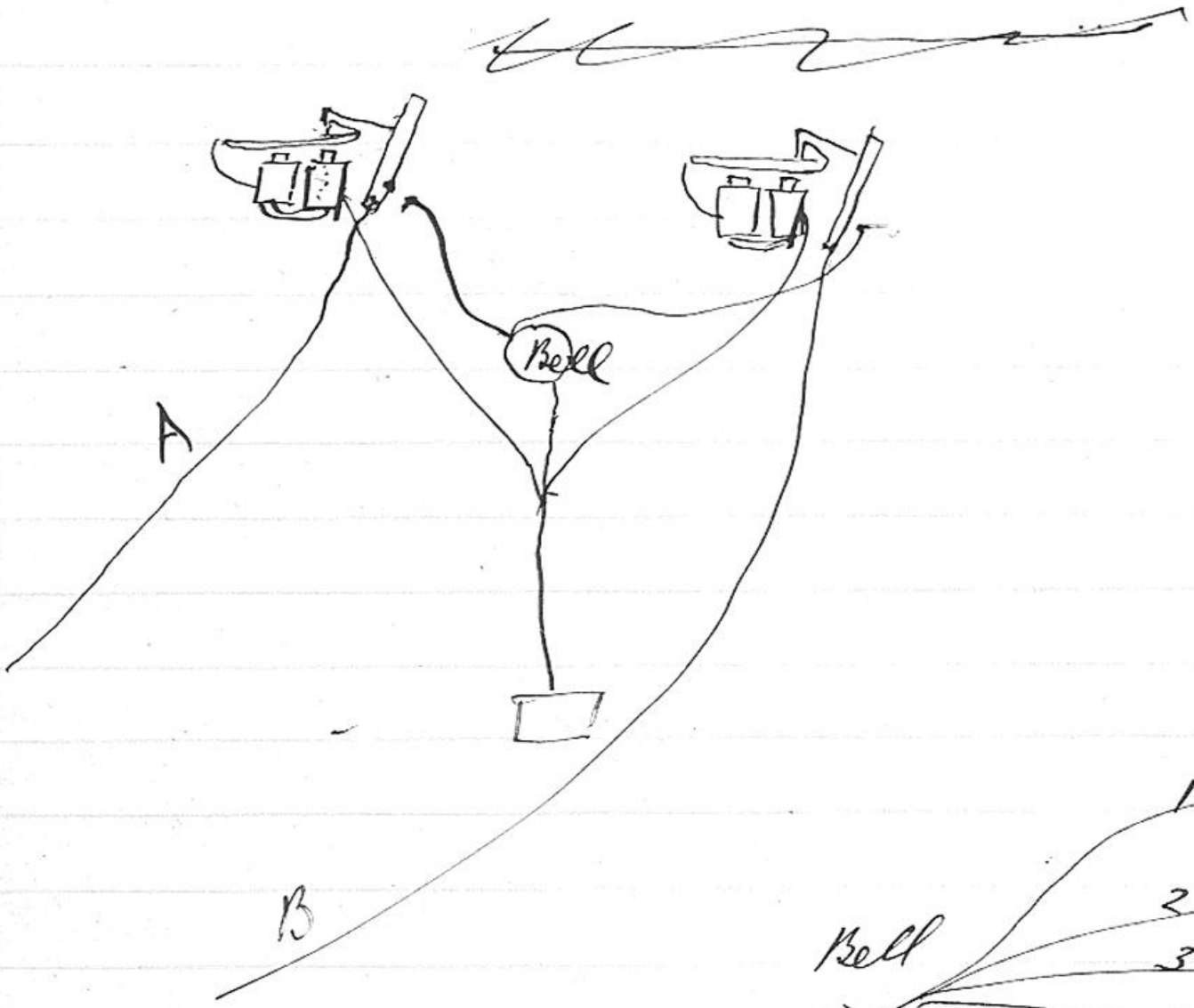
Line

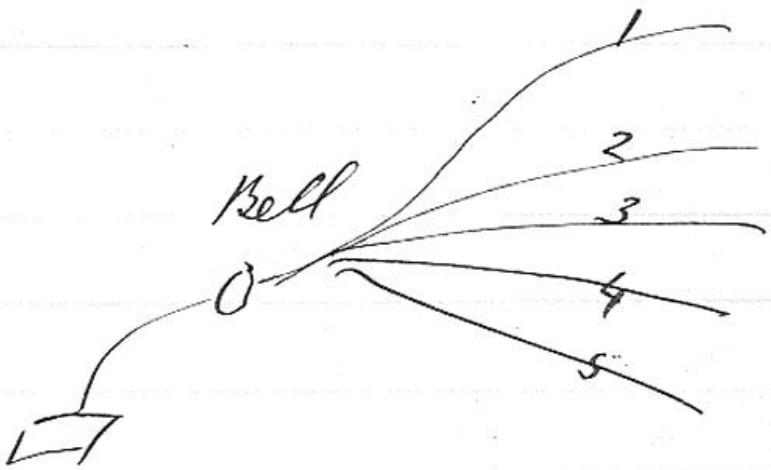


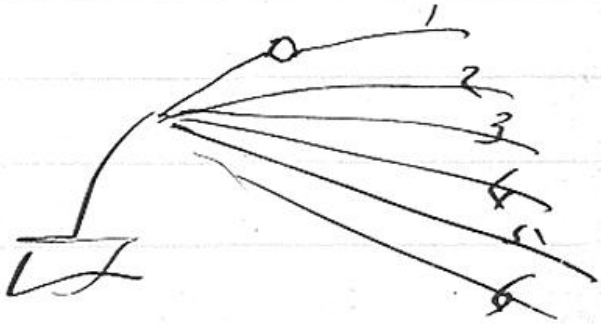
Line-wire



April 7th - 1878







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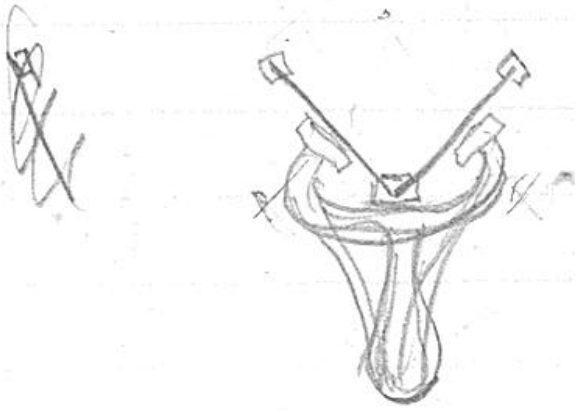
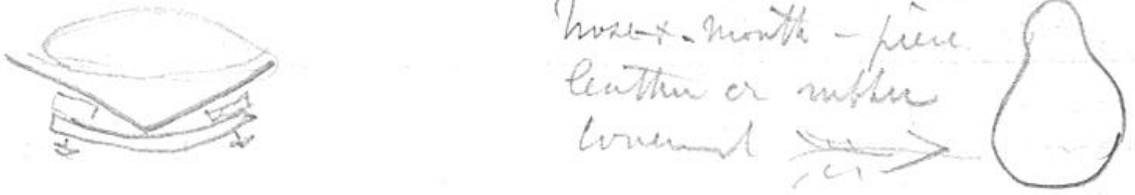
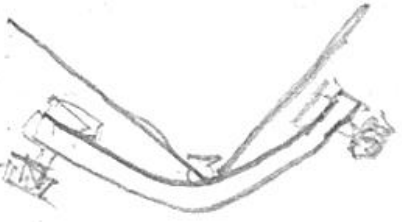
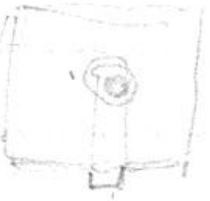
April 8. ½ 1878

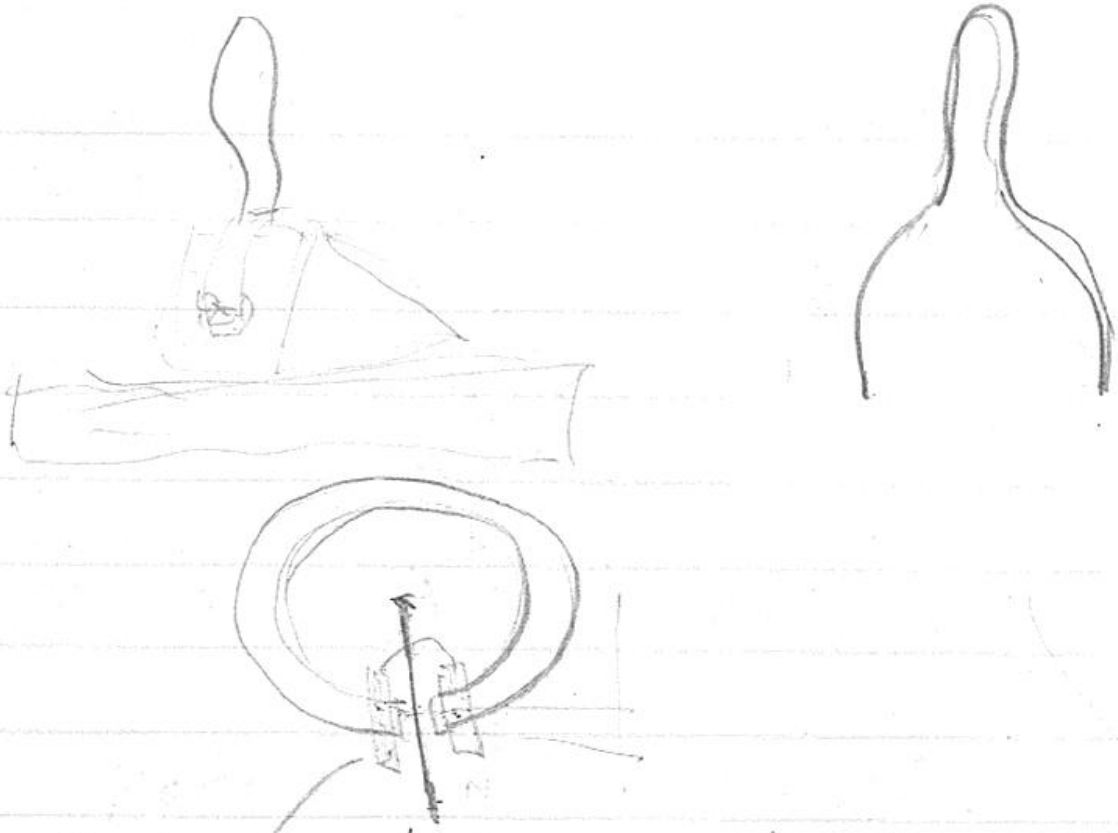


Nose + mouth – piece
leather or rubber
covered



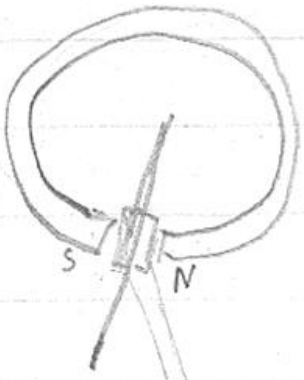






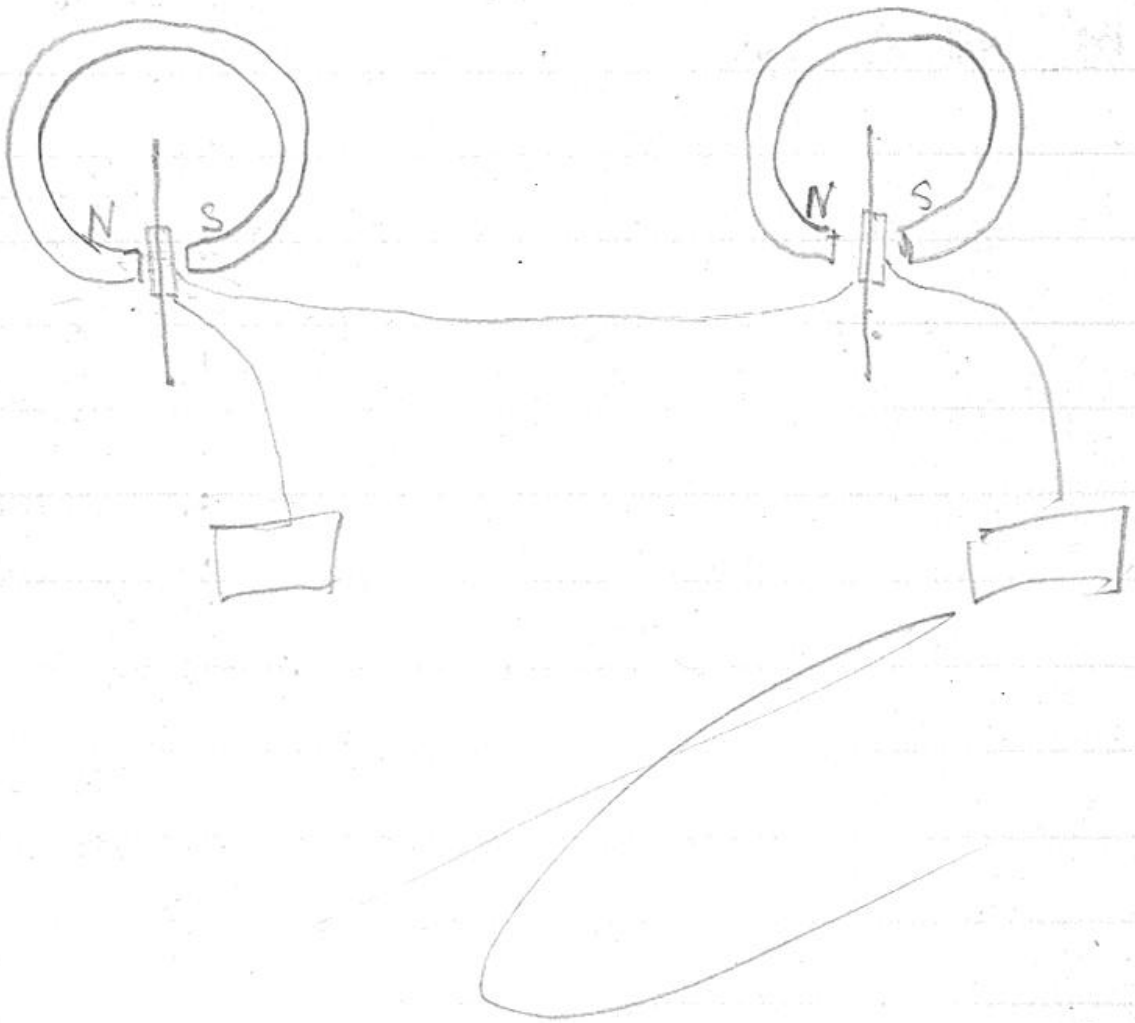
Old idea of poles on each side of plate neutralizes completely the un-undulatory character of current & will enable these timbre of loud sounds to be as perfectly copied as that of soft sounds. If we can only obtain in receiving instrument an alternate attraction & repulsion the energy of the vibration in the receiver may be enormously increased

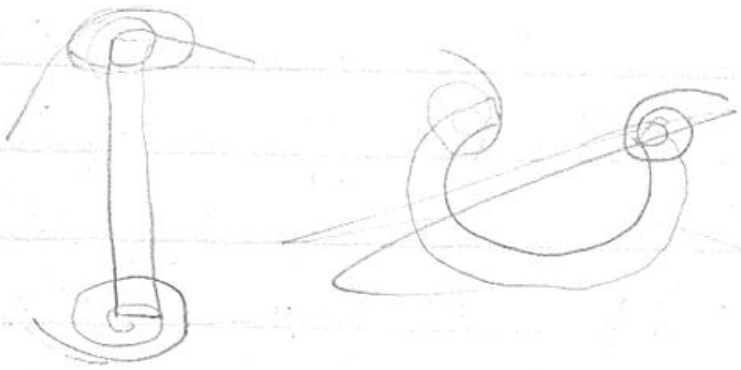
How would following idea do



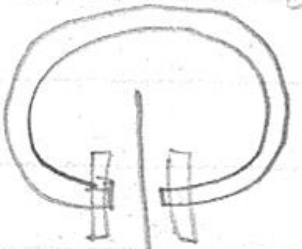
Have soft iron pole pieces + coils upon the plate instead of magnet.

Yes. Each pole of magnet would alternately attract + repel armature.



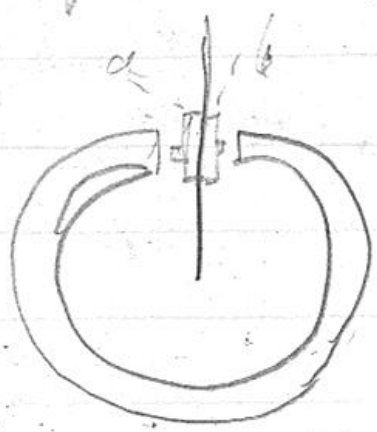


The above idea has already been tried but if I remember Right we were not careful about the Selection of the coils. ans.



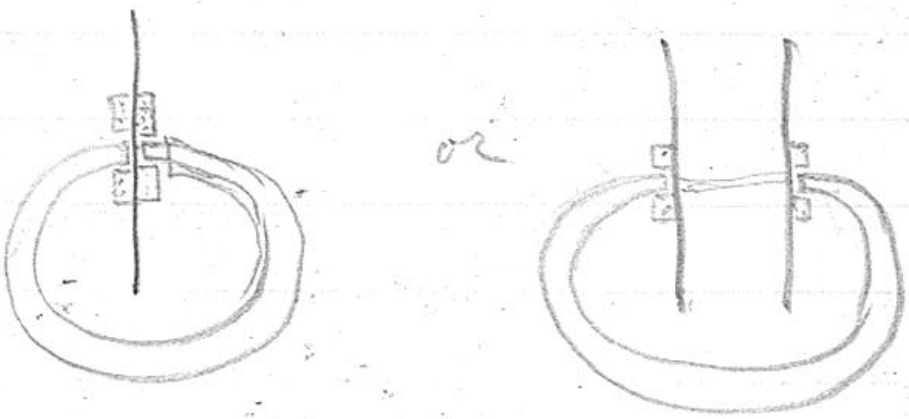
This idea has already been tried by Watson & myself and very poor effects produced. In fact almost nil. But I do not remember whether we noticed the importance of reversing one of the coils. If this is not done the removal of the plate from one pole will occasion a current of opposite kind to that produced by the approach to the other pole & the one current will neutralize the other. As an ideal

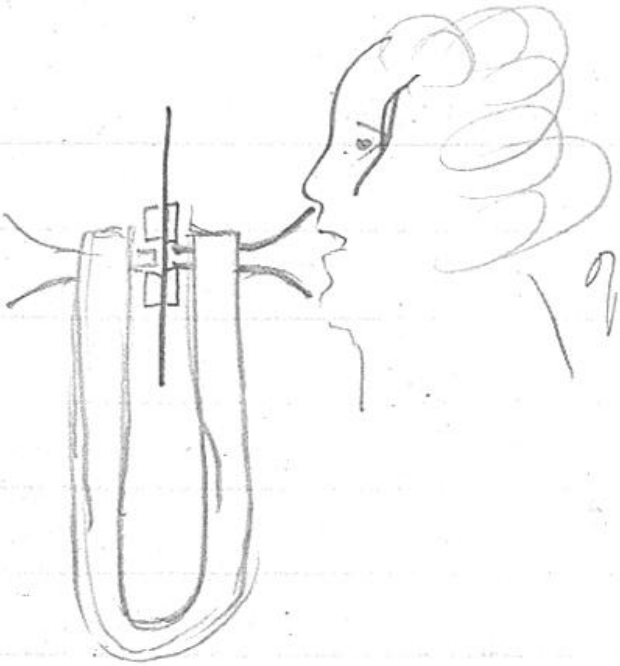
to the following arrangement



the coils a & b must be reversed. Otherwise opposite & consequently mutually neutralizing currents will be produced.

Perhaps still better arrangement is shown in section in the next Illustration ——





Want to obtain repulsion on one side and attraction on the other. No difficulty in vibrating plate. Common magnet may be arranged. Am afraid must have double plate.

Tuning fork coil arrangement

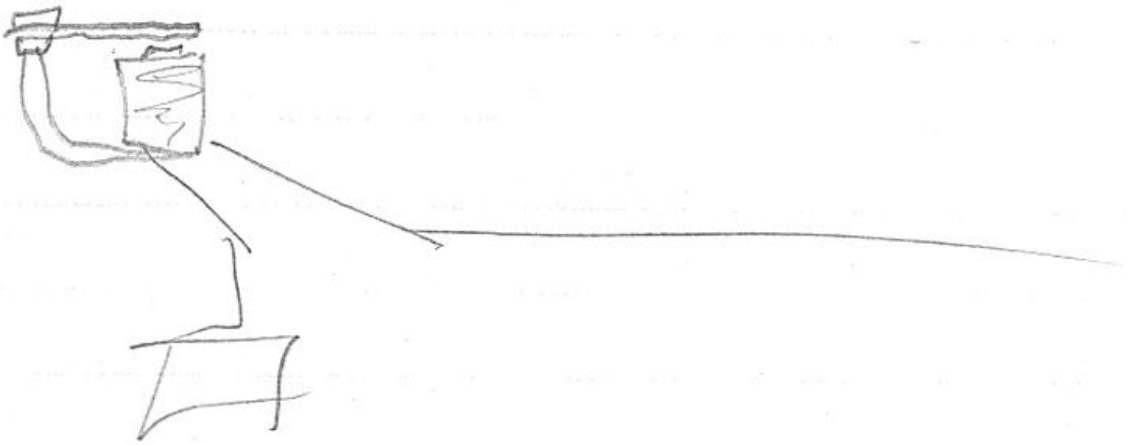
was failure on account of coil. No damping. The approach of two poles simultaneously will produce current in same direction.

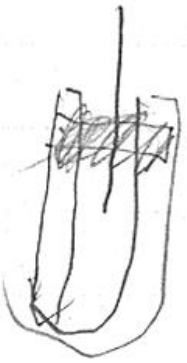
By the by the above was at the

arrangement tried but this is not the
the management of the coils would make

all the difference between maximum effects
& complete neutralization.

ag





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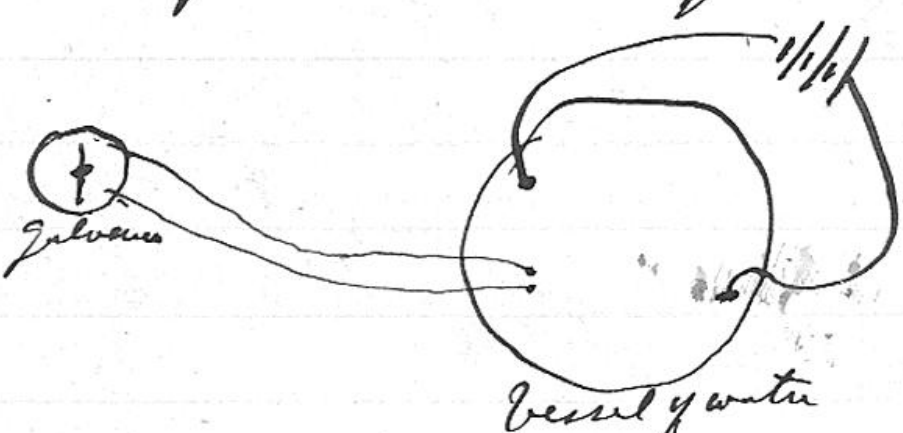
April 10th. 1878. Experiments made yesterday ~~with Earth Connections instead of~~ with metallic conductors very extraordinary. They throw light on nature of earth connections & show whether earth acts simply as an electrical reservoir or whether there is any real current established — or both.

The reservoir theory which seems the best appears at first sight inadequate to explain yesterdays phenomenea.

Test with galvanometer as follows.



Will there be any deflection? If so how much?

~~Each battery circuit the primary & galvano,~~ ~~then reverse.~~ Then test successively the

deflections.

Or still better.

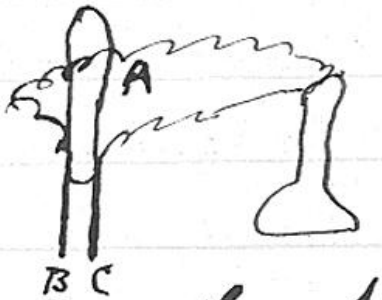
Take tub of water and connect in primary circuit

Make following experiment. Constant

insulated handle with two bare

wires B, C, connected with a

telephone D,



Telephone circuit to be ~~conducted~~ closed

by dipping wires BC into water.

~~Connect battery & key with battery~~ Use

this in place of galv. and if noise is heard

when battery circ. is opened & closed,

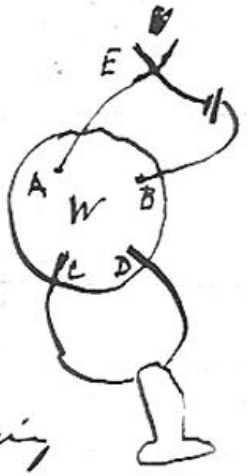
then for each point examined turn the

handle A so as to ascertain whether the

direction BC affects result.

April 11th. Made experiment shown on page 21.

W. Basin of water
A.B. Battery terminals
C.D. Telephone Terminals



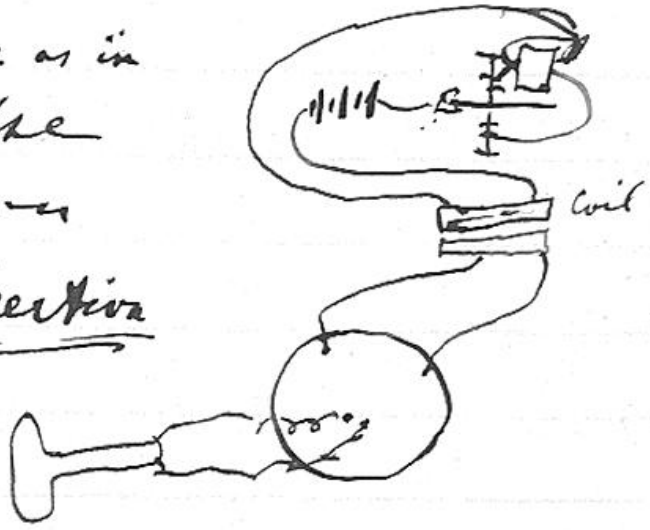
One cell Le Clanche battery in bad order.

Upon making & breaking the battery circuit at E clicking sounds were plainly audible in Telephone. The sounds became louder when a few drops of sulphuric acid were added to the water.

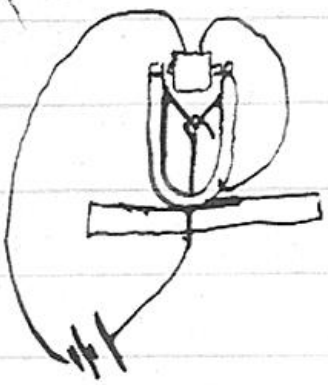
Experiments to try.

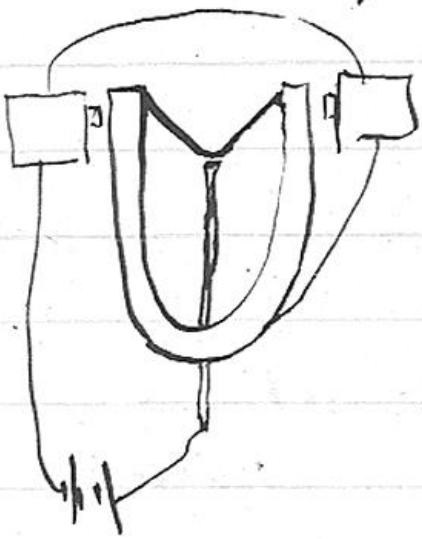
Open & close Telephone circuit.

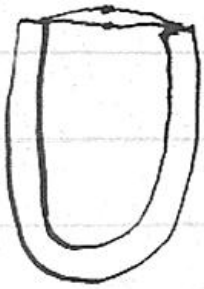
Try induced current from rheotome as in next drawing. Use insulated handle shown on page 20 & note the direction of BC for the maximum and minimum effects.



April 12th. New current interrupter suggested by remarks of Mr. Nicholas Bryant last night.







April 17th. Hailstorm accompanied by thunder & lightning today. Held ~~two~~ telephones one to each ear (the terminals being uncovered) and distinctly heard a clicking sound ~~in~~ in the telephone at the moment a flash of lightning appeared. It seemed as if there was a double click. but the opportunities for observation were so few that I cannot be certain of any other point than that a noise was produced from the telephone at each flash of lightning.

May 4th 1678 — Impact of atoms.

Premises. 1. Persistence of force i.e. the quantity of motion cannot be altered.

2. vis inertiae

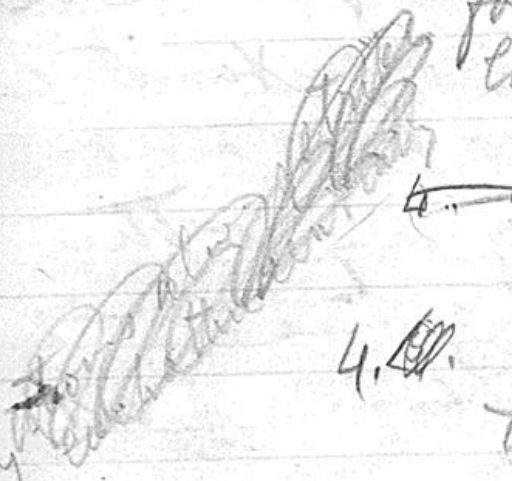
3. motion proportional to moving force impressed and in straight line of forces direction.

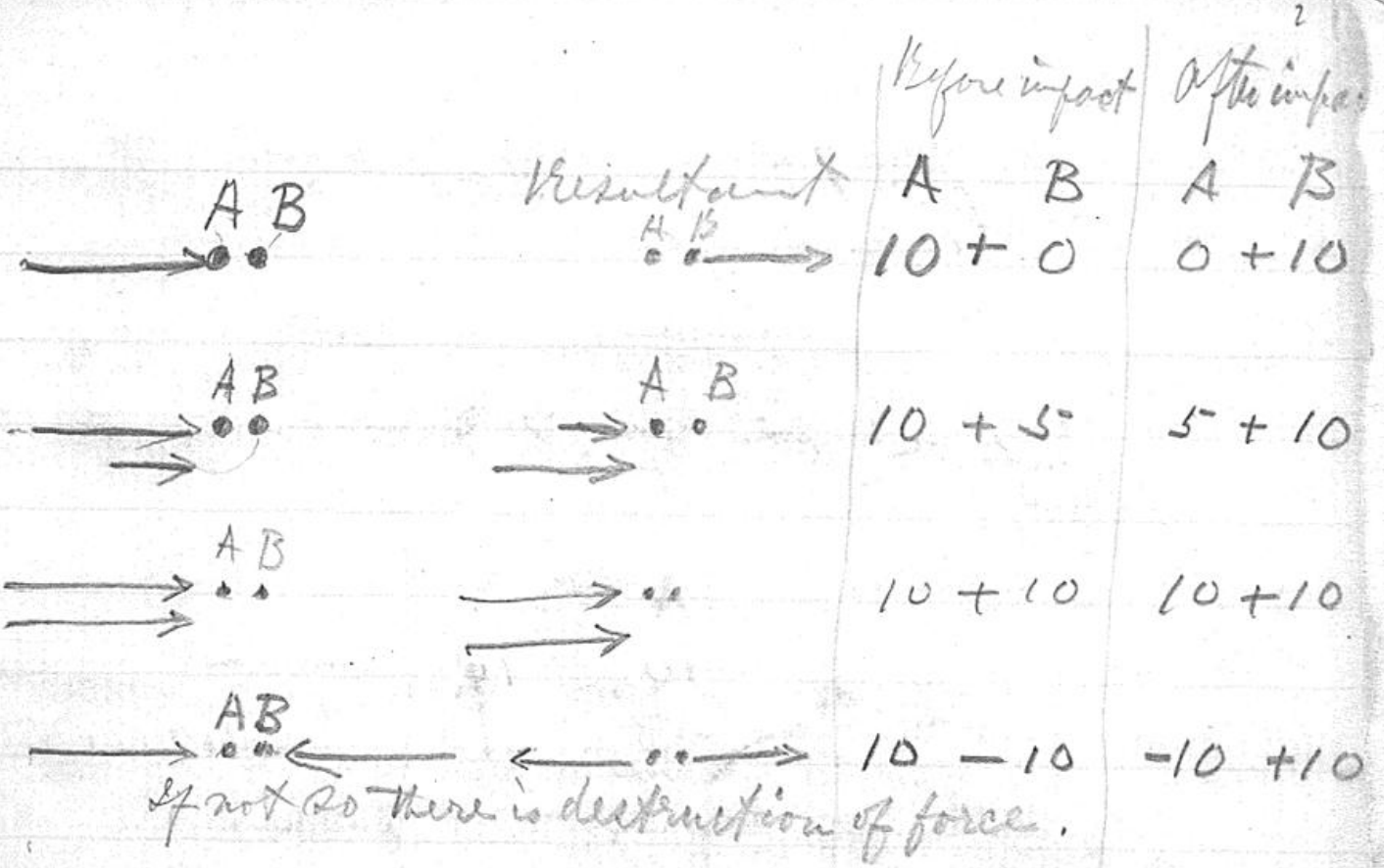
~~4. Reaction equal & opposite.~~

4. Motion can only be com-municated to an atom by the impact of ~~another~~ other atoms.

5. Atoms can and move as wholes their parts and incapable of independent motion. But rotatory motion possible.

Take simplest case. Impact of 2 atoms equal in mass. Represent original motions of atoms by dark lines & resultant motions by dotted lines





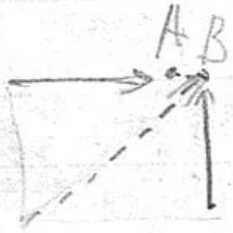
	Before impact		After impact	
Resultant	A	B	A	B
	10	+ 0	0	+ 10
	10	+ 5	5	+ 10
	10	+ 10	10	+ 10
	10	− 10	−10	+ 10
	10	− 5	−5	+ 10

If not so there is destruction of force.

In every case of impact in a straight line the atoms must exchange conditions otherwise there is a destruction of force. The principle of least ~~action~~ by concussion is inadmissible with atoms for they can only move as wholes. ~~If conservation of energy is correct — a solid particle acts as an elastic sphere.~~

Having considered impact in straight line - consider impacts at angles.

Impact at right angle:

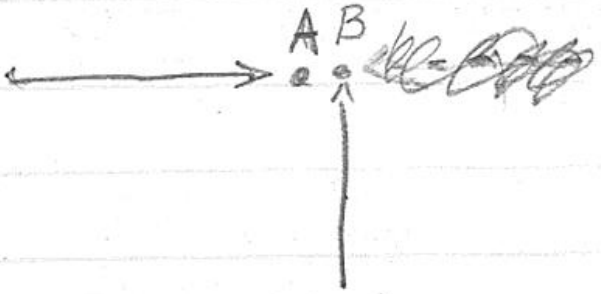


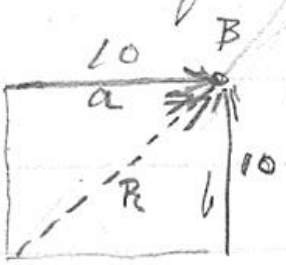
$R^2 = A^2 + B^2$

Before impact		after impact
A	B	B
10	10	$\sqrt{200}$
		20.000000
		14.14213562
		.58578644

Case 1st Impact at right angles.

Motion for B





$R^2 = a^2 + b^2 = 200$

$R = \sqrt{a^2+b^2} = \sqrt{200}$

$R = 14.142135-6$

B's motion will be in direction of dotted line. What will A's motion be?

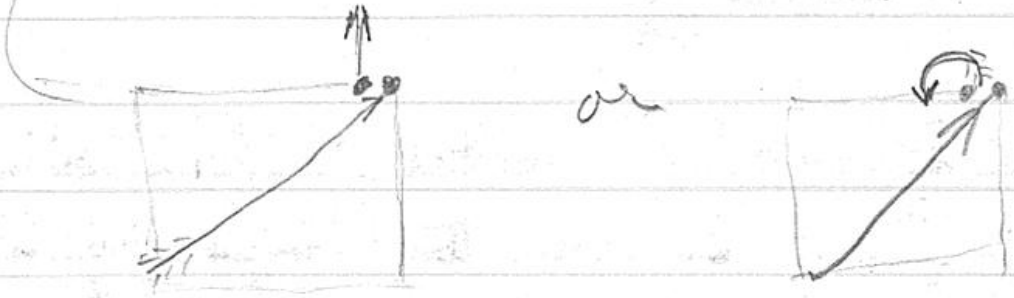
& quantity of motion remains A's motion should be $R' = A+B-R = 20-R$

$R' = 5.85-78644$ but in what direction?

If B were at rest the reaction of B upon A would cause A at rest — for B has no tendency to move in the line of A's motion.

Resultant motion of A along line A is therefore Nil and A can only move in the direction of B's original motion or spin upon its axis with a left-handed motion !!?

That is Resultant is either

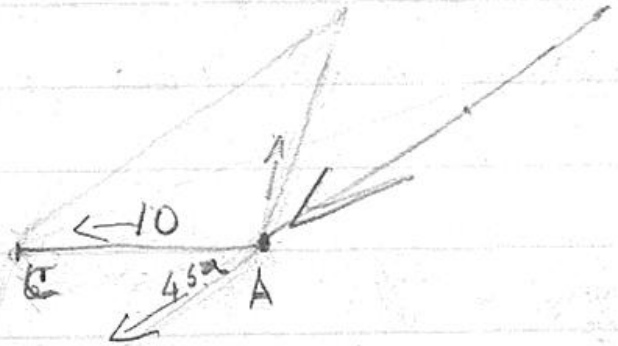


In the latter case A's onward motion would be stopped and it would simply rotate.

~~Either~~ The best way of deciding which is right is to reverse operation & see whether original motions could be deduced.

Resume B as in next page

Given B's motion. What motion must A originally have in order that impact of B should send it in direction of arrow-head with velocity 10.



$\angle B : \angle C :: 10 : 14$

$\angle B + \angle C = 180^\circ - 45^\circ = 135^\circ$

$\angle B = \frac{45^\circ}{135^\circ} \times \frac{10}{24} \frac{5}{12} = \frac{225^\circ}{4}$

$\angle C = \frac{45^\circ}{135^\circ} \times \frac{14}{24} \frac{7}{12} = \frac{315^\circ}{4}$

$\angle B = 56.25^\circ$

$\angle C = 78.75^\circ$

$\angle A = 45.00$

Total $180^\circ.00$

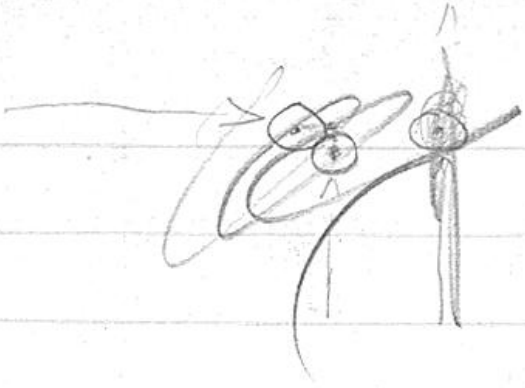
79 | 630 (8

4 | 315
78.75

4 | 225
56.25

79 : 45 :: 14 : 630

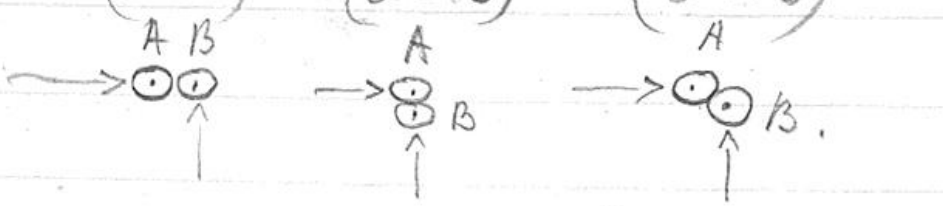
10 / 180 / 45



In considering effect of impact of, evident result depends upon the parts of the atoms which come into contact & hence result depends upon shape - size of atoms as well as the direction of motion. Consider atoms as spherical & of equal size & mass,

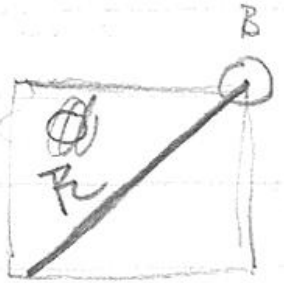
Let particles move into collision with equal velocities but directions at ½ & ¼ angles as in following cases

(Case 1) (Case 2) (Case 3)



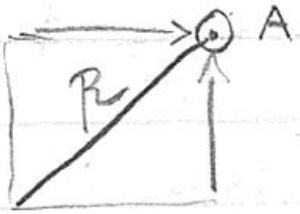
Over

Case 1

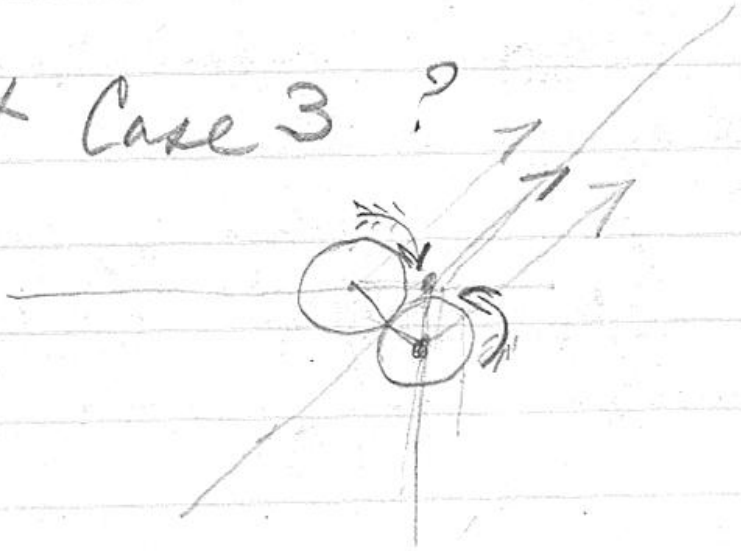


In case 1 the motion of B (which is centrally struck) is evident ~~[illegible]~~ but motion of A is uncertain in my mind.

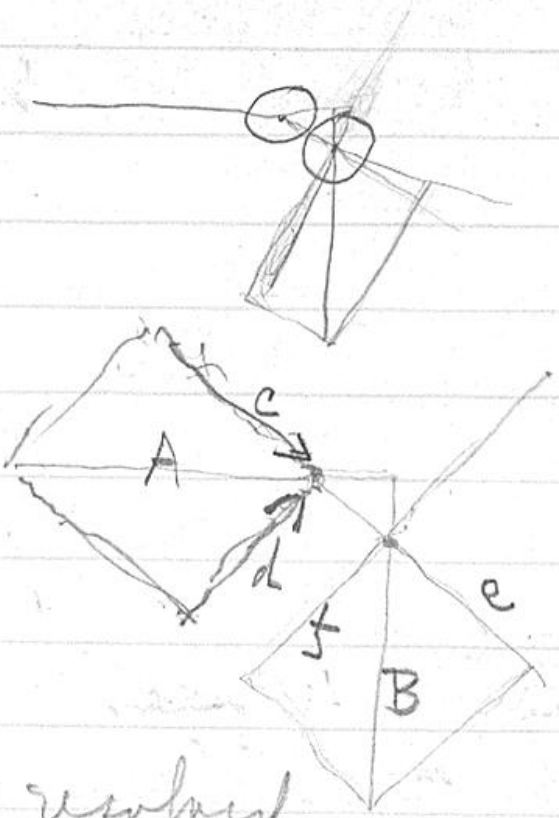
So in case 2 the resultant motion of A is evidently what B is in the first case but condition of B is not certain in my mind.



How about Case 3?



May 6th 1878



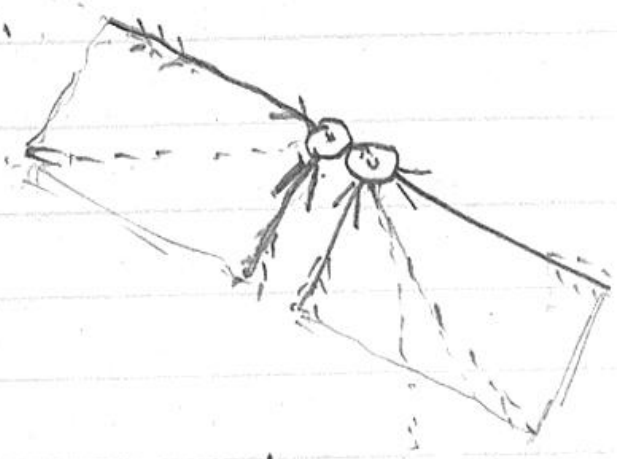
A's motion may be resolved into c + d

B's — e + f

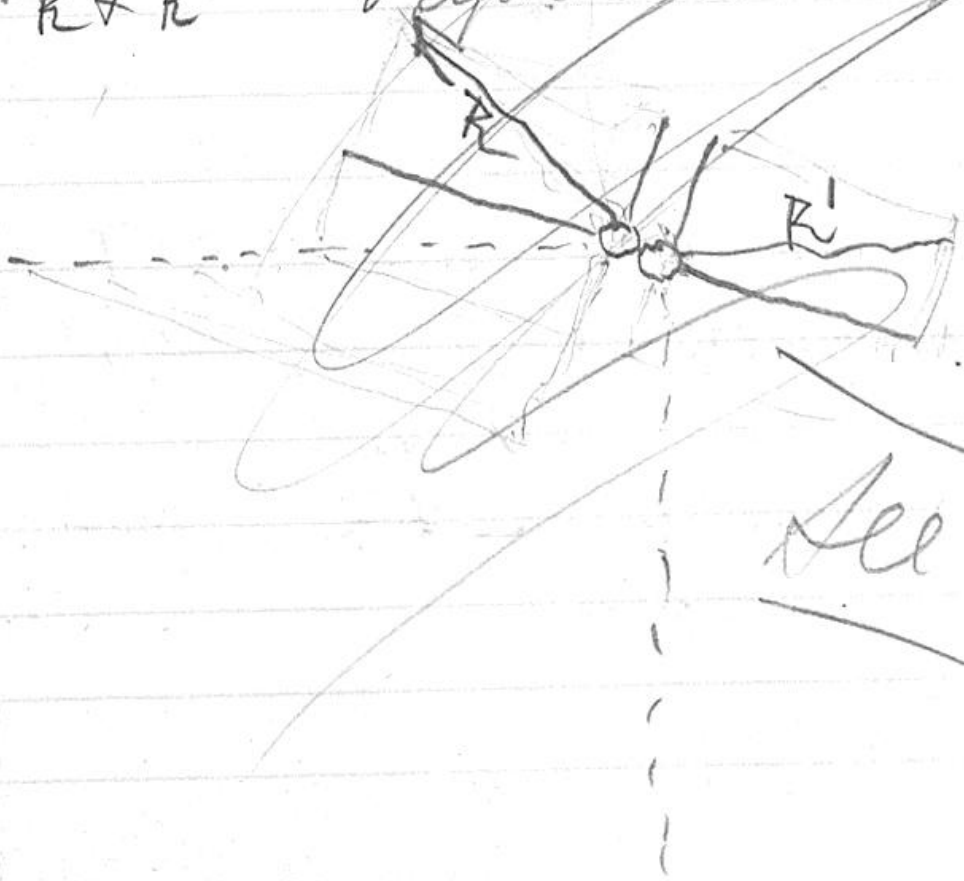
But c + e are in the same straight line + in opposite direction — Hence the atoms A + B — will exchange conditions, so far as c + e are concerned. Hence

ovh

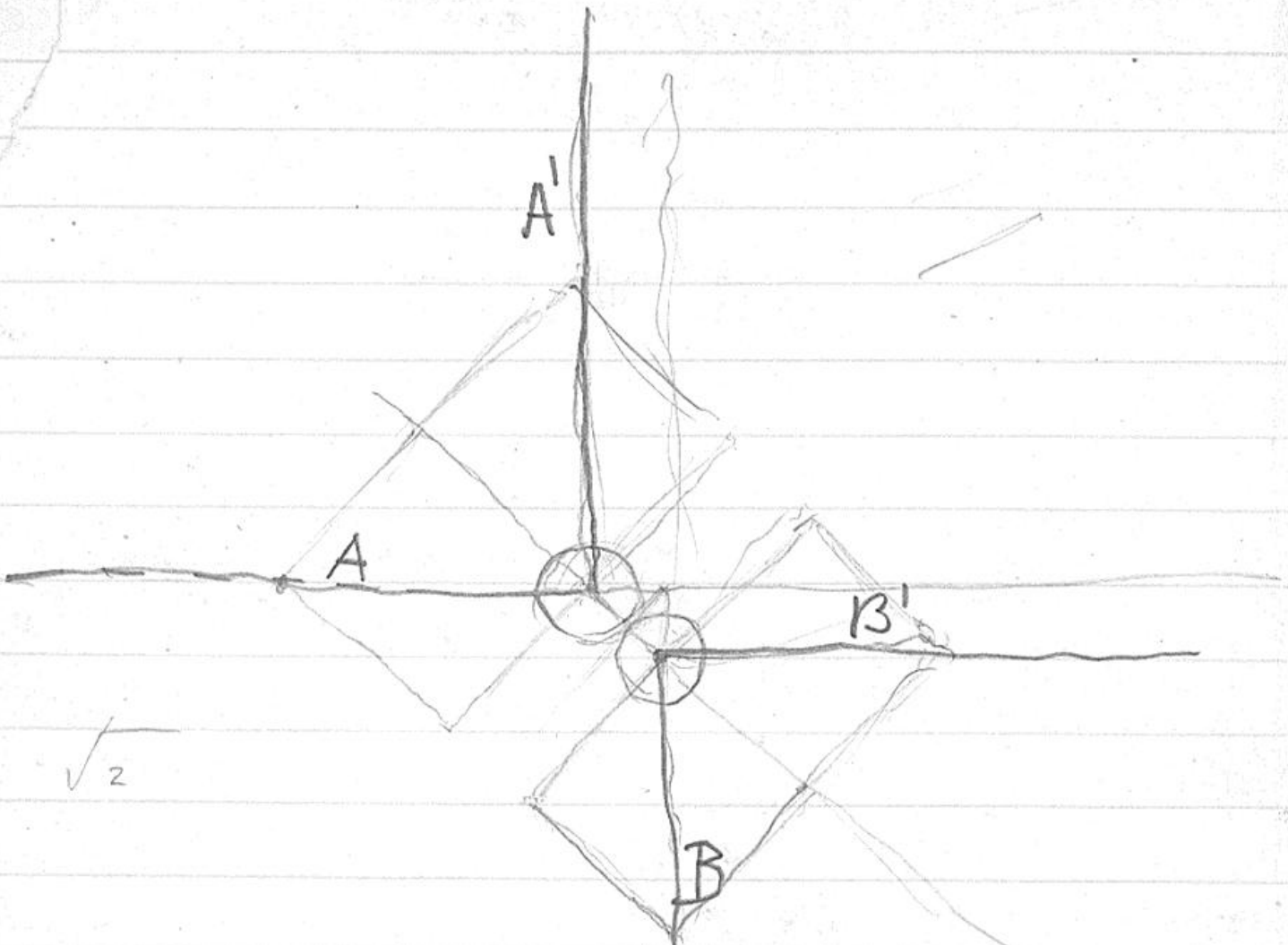
Before impact —
Forces resolved into direct + tangential forces.



After impact. Direct + tangential forces in dark lines. Resultant motion R + R'. Original motion in dotted line.



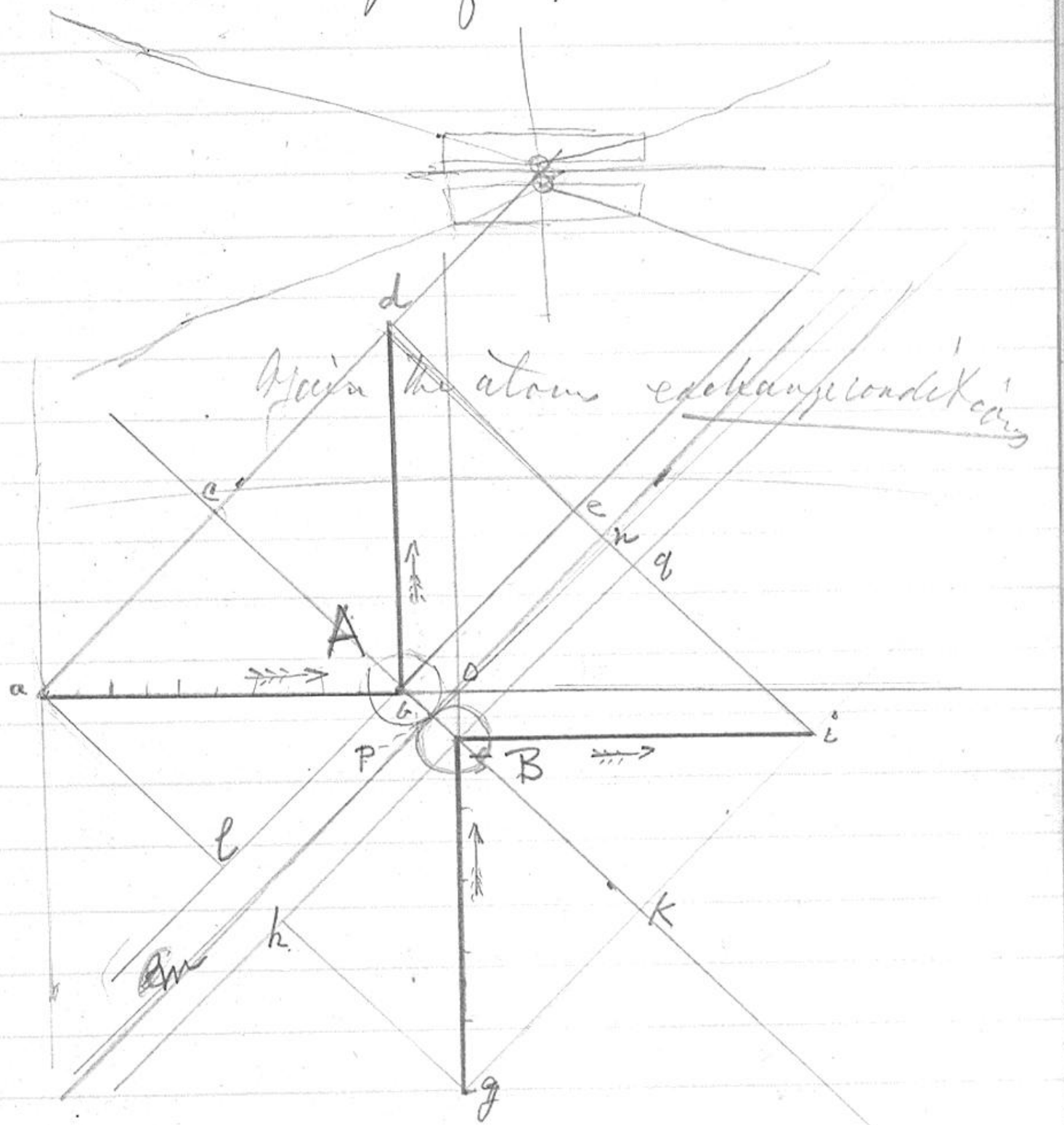
Sea wall



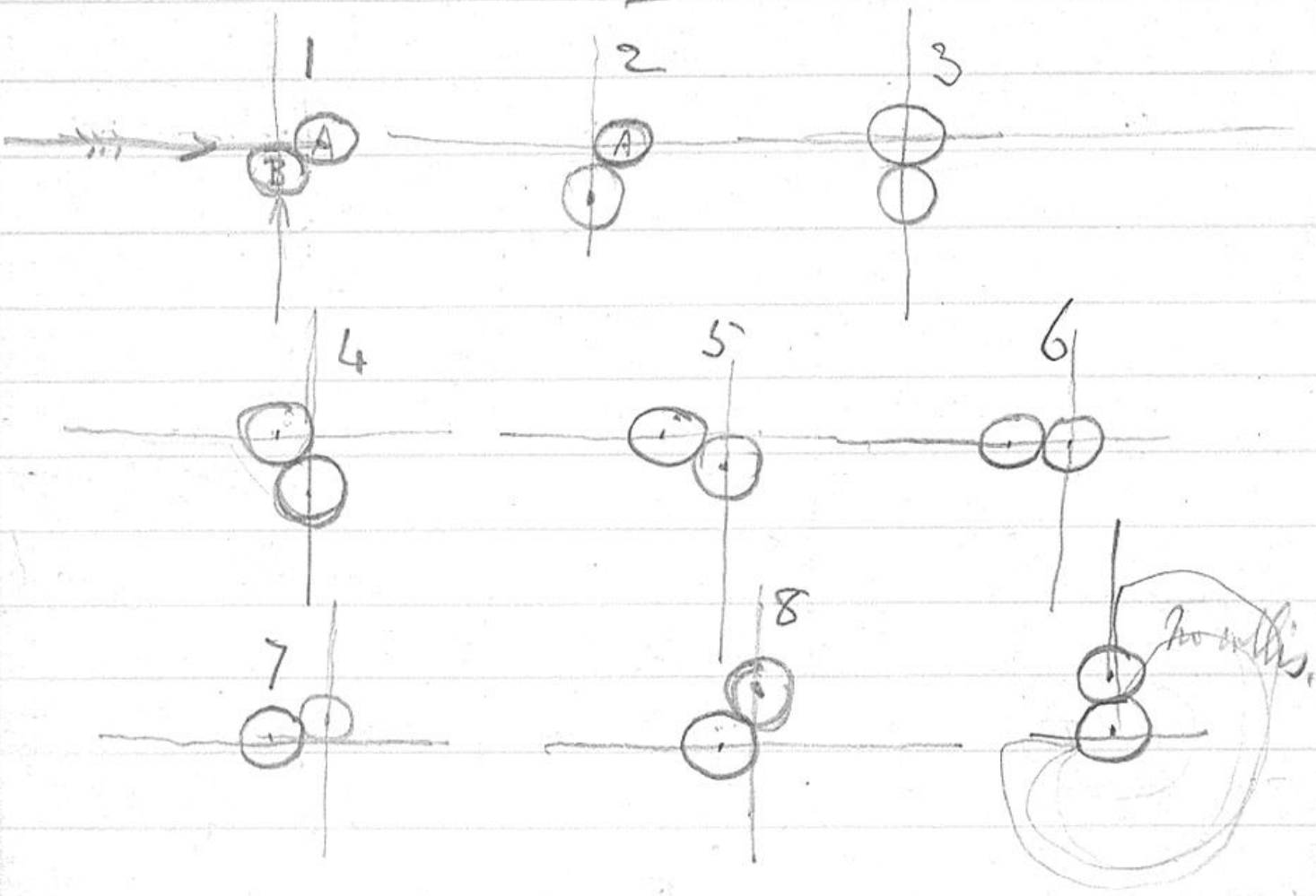
Original direction of $A \times B = A \times B$.
Final direction of $A \times B = A' \times B'$

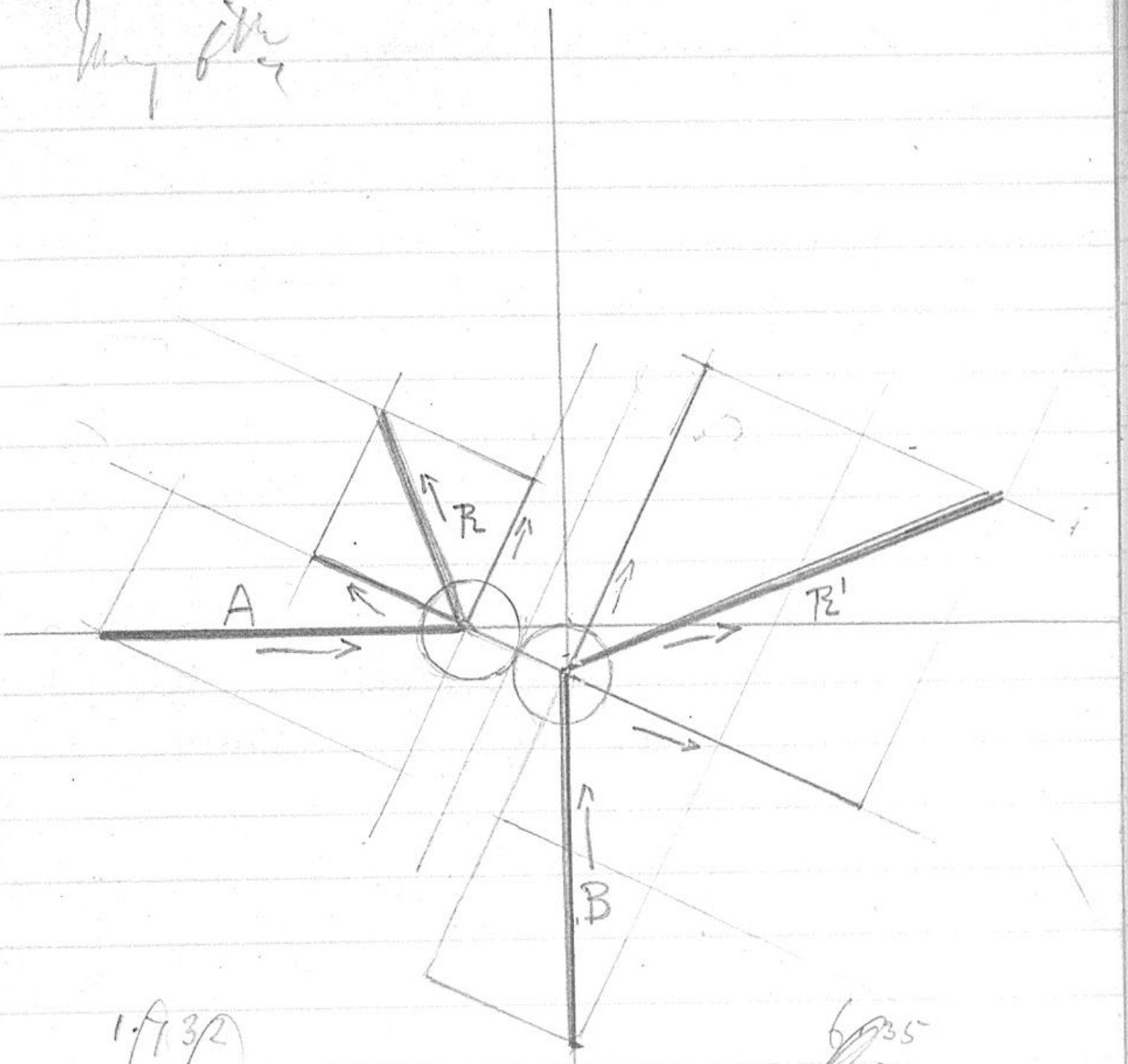
Again the atoms ~~upon~~ ~~after~~ impact exchange conditions.

Angle of impact = 90°



Investigate following cases





$$R = \sqrt{2} = 1.4142$$

$5 \overline{)1285}$ 75

257

22

1305

261

$5 \overline{)1200}$

240

1256

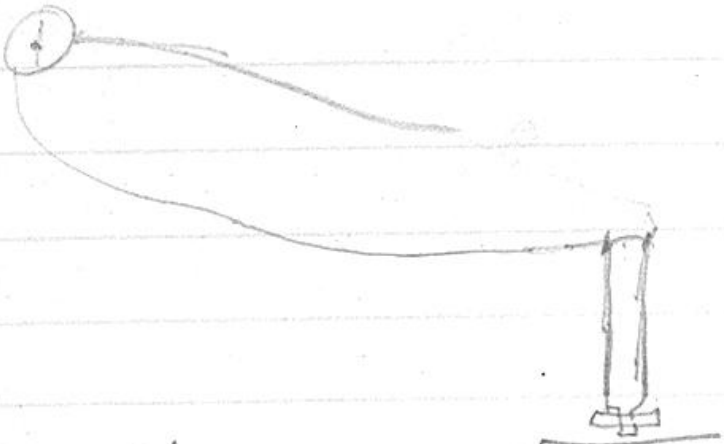
2512

1200

$5 \overline{)924}$

184.8

May 6th



Mean of wound from plate.
Zinc plate varied.

~~Zinc plate~~
Readings

1 Cm. =	72, 70, 71, 72, 70	= 71
2 Cm. =	160, 165, 164, 163, 170	= 164·4
3 Cm. =	205, 201, 203, 200, 200	= 201·8
Pressed firmly. 4 Cm =	~~281~~, 262, 262, 260, 262, 264,	= 262
3 Cm. =	245, 241, 237, 238, 239	= 240
3 Cm. =	240, 241, 238, 241, 240	= 240
2 Cm =	192, 182, 188, 182, 180	= 184·8
2 Cm =	170, 172, 175, 170, 180	= 173·4
5 Cm =	260, 245, 258, 270, 252	= 257
5 Cm. =	248, 262, 260, 260, 275	= 261
4 Cm =	261, 240, 253, 240, 262	= 251·2

The deflections obtained are hardly sufficiently uniform to be trustworthy.

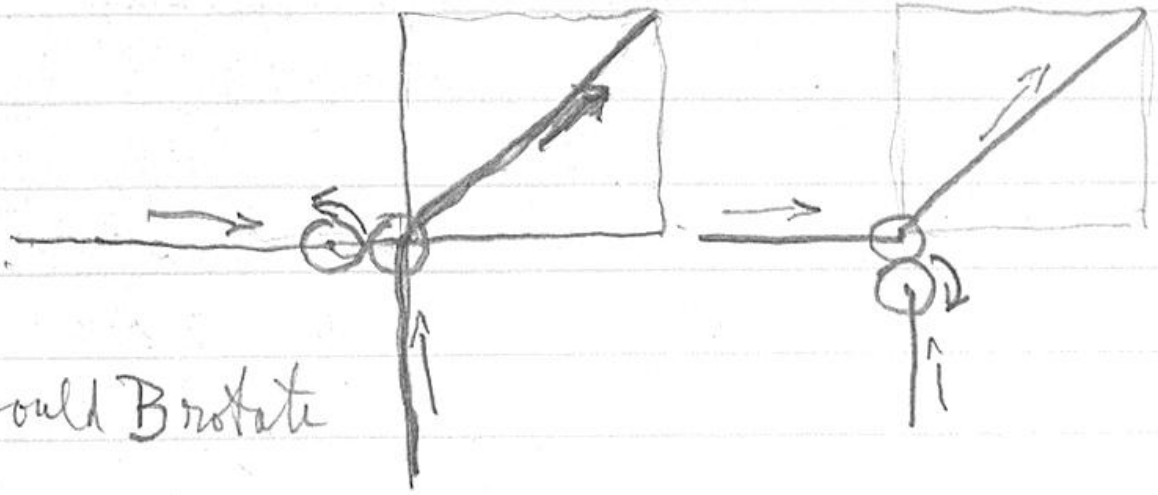
Remove magnet to a great distance from plate. Traces only removed to a distance of about 2 inches.

14 Cm. plate gave very little more deflection than 5" cm. plate.

There is a limit to size of plate that is advantageous.

Take diam. of magnet - length - + power + also size + position of coil.

May 7th 1878



Or would B rotate

O

May 8th 1878

Baby born at 6.45 p.m.

~~May 9th~~ Baby weighed = 7½ lbs ~~exactly~~

~~exactly~~ 16 ounces to the pound.

$5\overline{)967}$

193.4

$5\overline{)1246}$

249.2

$5\overline{)1411}$

282.2 2

$5\overline{)1448}$

289.8

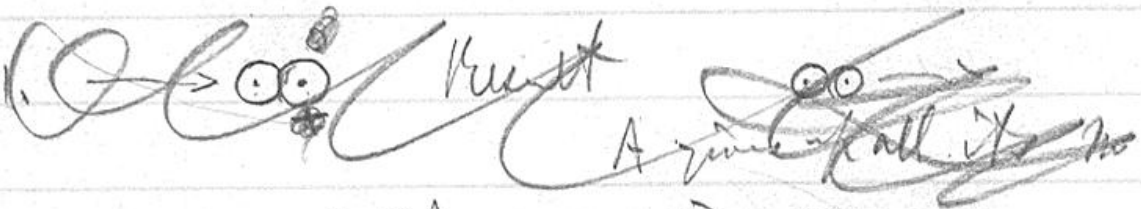
May 9th 1878

Experiments with plates 7 diff. sizes continued; plate quantity fully covering.

Readings for Deflections

2 cm. 191, 193, 197, 195, 191, = 193.4
3 cm. 249, 245, 250, 252, 250, = 249.2
4 cm. ~~258~~, 272, 272, 272, 272, 272 = 272
5 cm. 283, 277, 283, 285, 283, ~~280~~ = 282.2
6 cm. ~~265~~, 289, 289, 291, 293, 287 = 289.8

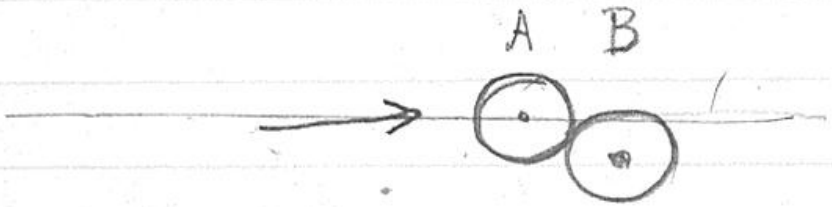
May 9th Impact of atoms in strong fields
time. Phases of impact

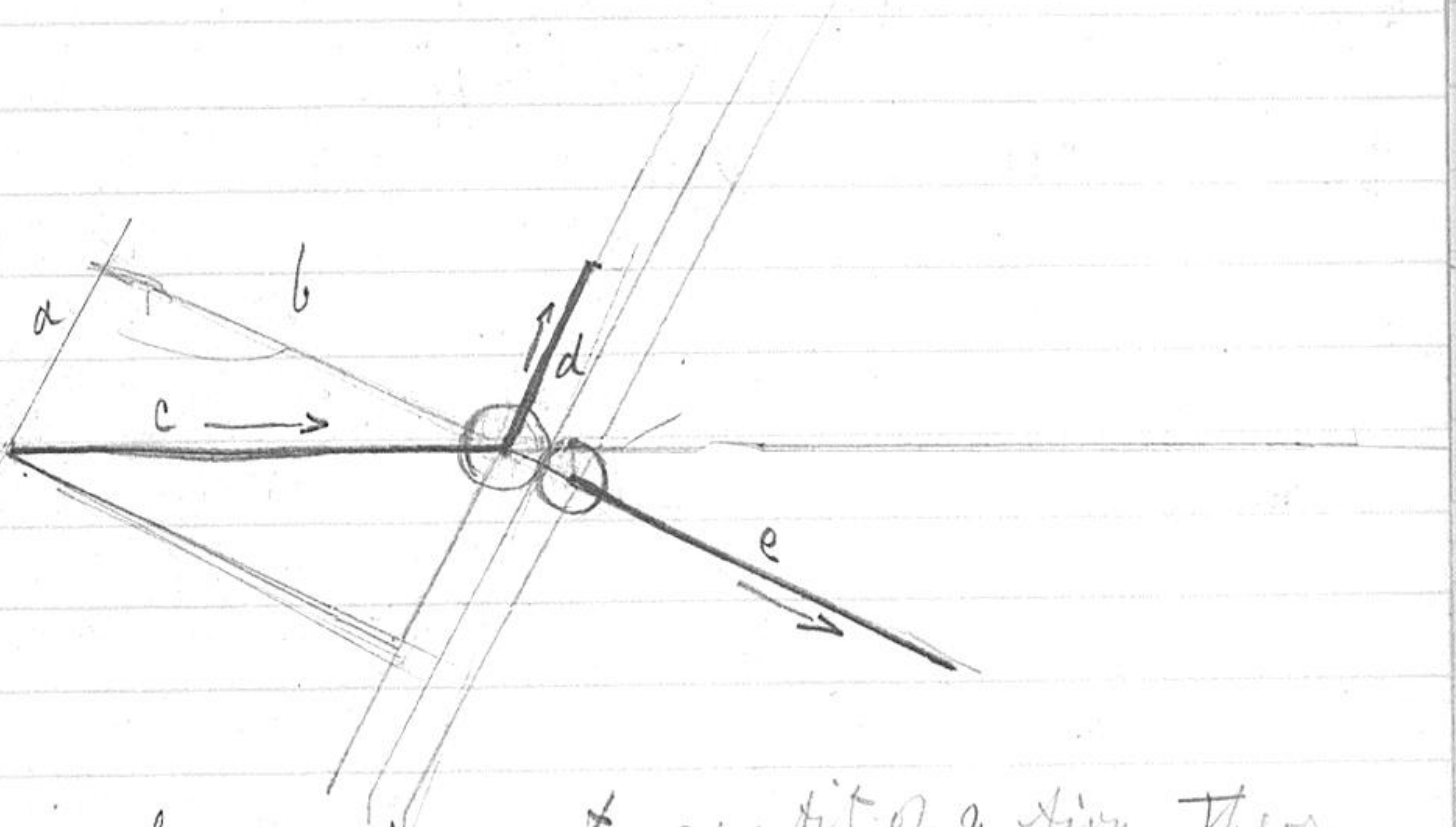


Case 1.

Case 2.

Case 2.





If above is correct quantity of motion theory incorrect for $a+b > c$ i.e. $d+e > c$ which is opposed to the theorem that the quantity of motion is ever the same

Two sides of triangle are together greater than the third, $a+b$ greater than c hence $d+e$ greater than c. i.e. a greater quantity of motion is obtained than that originally possessed.

$\sqrt{33}$

166

$\sqrt{1127}$

225.4

$\sqrt{1175}$

233

$\sqrt{1521}$

304.2

$\sqrt{1265}$

253

$\sqrt{1515}$

303.2

$\sqrt{1315}$

263

$\sqrt{1316}$

263.2

$\sqrt{1403}$

280.6

$\sqrt{1444}$

288.8

$\sqrt{1453}$

290.6

May 10th 1878 – Reflections on times.

2 Cm. 172, 165, 168, 160, 168, = 166.6

3 Cm. 222, 235, 230, 225, 225, = 225.4

4 Cm 235, 238, 238, 242, 242 = 238

5 Cm 268, 250, 245, 260, 262 = 257

6 Cm ~~260~~ 262, 260, 260, 265, 270 = 263

7 Cm 282, 250, 250, 282, 252 = 263.2
260, 282, 285, 278, 278 = 280.6

8 Cm 282, 292, 289, 292, 289 = 288.8

9 Cm 292, 290, 293, 293, 285 = 290.6

10 Cm 300, 310, 309, 310, 292 = 304.2

11 Cm

12 Cm

13 Cm

14 Cm. 318, 309, 306, 306, 312, = 310.2

Over

My wife Mabel says that
[illegible] was
[illegible]
[illegible]
[illegible].

May 10th 1878

Single readings of
Tin & Russia iron.

	Tin	R. Iron
2 cm.	185	152
3 cm	220	198
4 cm	239	218
5 cm	252	222
6 cm	270	235
7 cm	275	230
1 Cm.	72	62

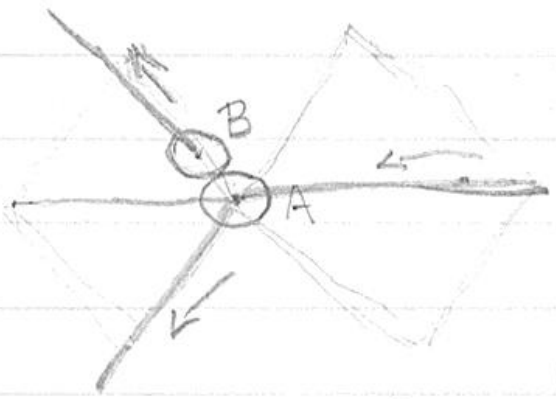
May 10th 1878

Triangle of Forces inconsistent with permanence of force. It not only demands (statically) that the force represented by one side of triangle balances the two others — but (dynamically) that the motion represented by one side is ~~equivalent to the motions represented~~ the resultant of the other two sides in magnitude & direction — not only the resultant but the equivalent for the resolution of forces shows that any force represented by one line of a triangle can be split up into two other forces represented in magnitude & direction by the other lines of the triangle.

Thus force A can be split up into two other forces B & C.

But as ~~or~~ two sides of a triangle are together greater than

For the third side — the sum of the motions B & C are together greater than the motion A which is inconsistent with principles of force. Indeed the perpetual motion would be possible if this is true & work be obtained without loss of energy. For instance Let ~~O.S.C.~~ A strike B ~~as they~~ as shown below. Before The forces can represented by an equilateral triangle. The sides are equal. and A & B. ~~would~~ ~~start off~~ after impact each start off on different paths with velocities equal to the original velocity of A, but is the quantity of motion is doubled. Let each one strike other atoms in a similar manner & the original motion can be multiplied as infinitum.



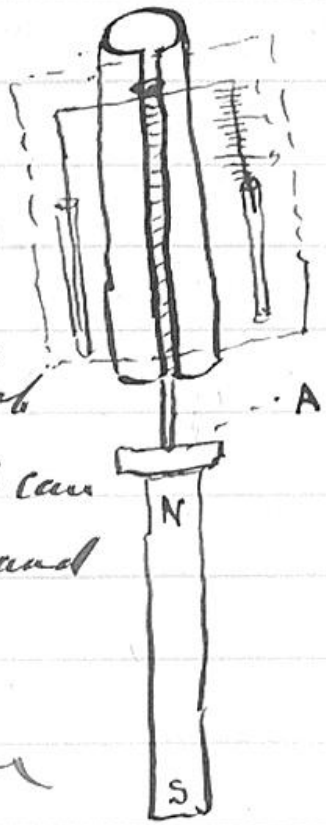
May 12th Chester University Inc

that the energy of a body is expressed by the mass into the square of the velocity. To take care of two forces acting at right angles. The square of the hypotenuse is equal to the sum of the squares of the other two sides. ft

Must study more. Not confidence in any mathematical work of my own.

May 22d 1878

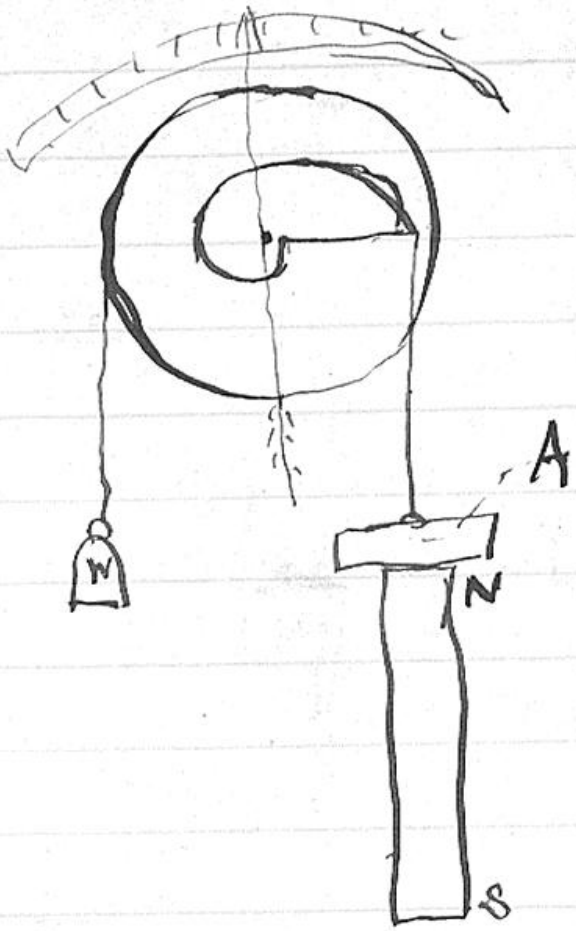
Apparatus for measuring the power of a magnet.

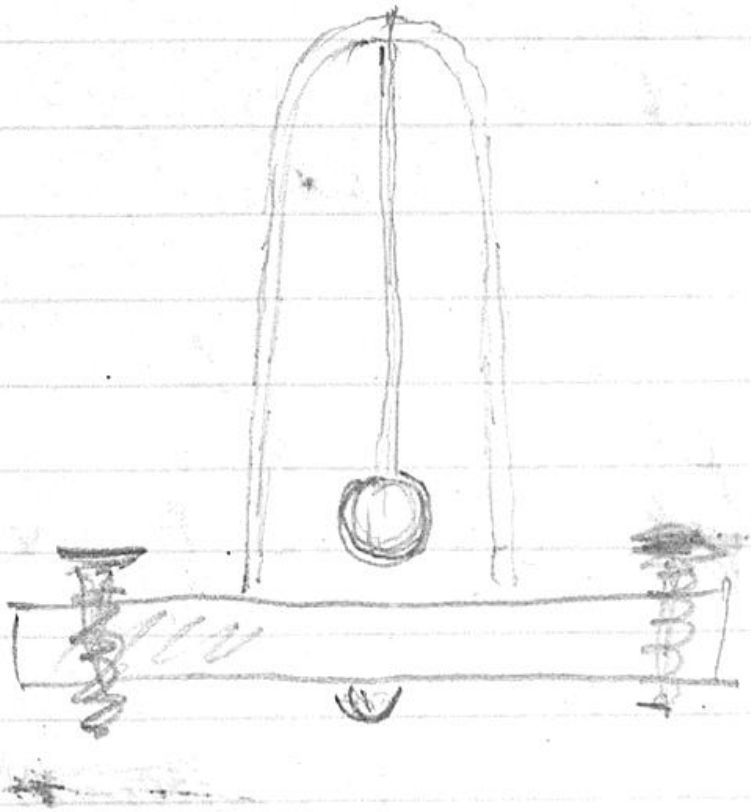


Attach armature A to wooden rod index coiled spring — and note the point to which a given magnet N S can draw down index hand

Or see over page —

Over


A
W
N
S



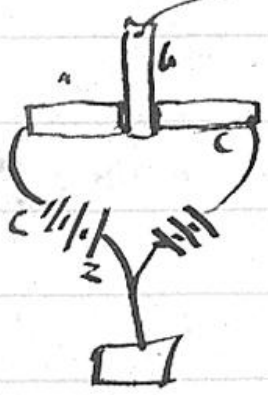
White floss silk

May 24th 1876

Microphone. Principle to conduct, introduce substances of low resistance & increase its resistance almost to infinity. Converse of Water Telephone which uses very introd. high resist. & decrease it.

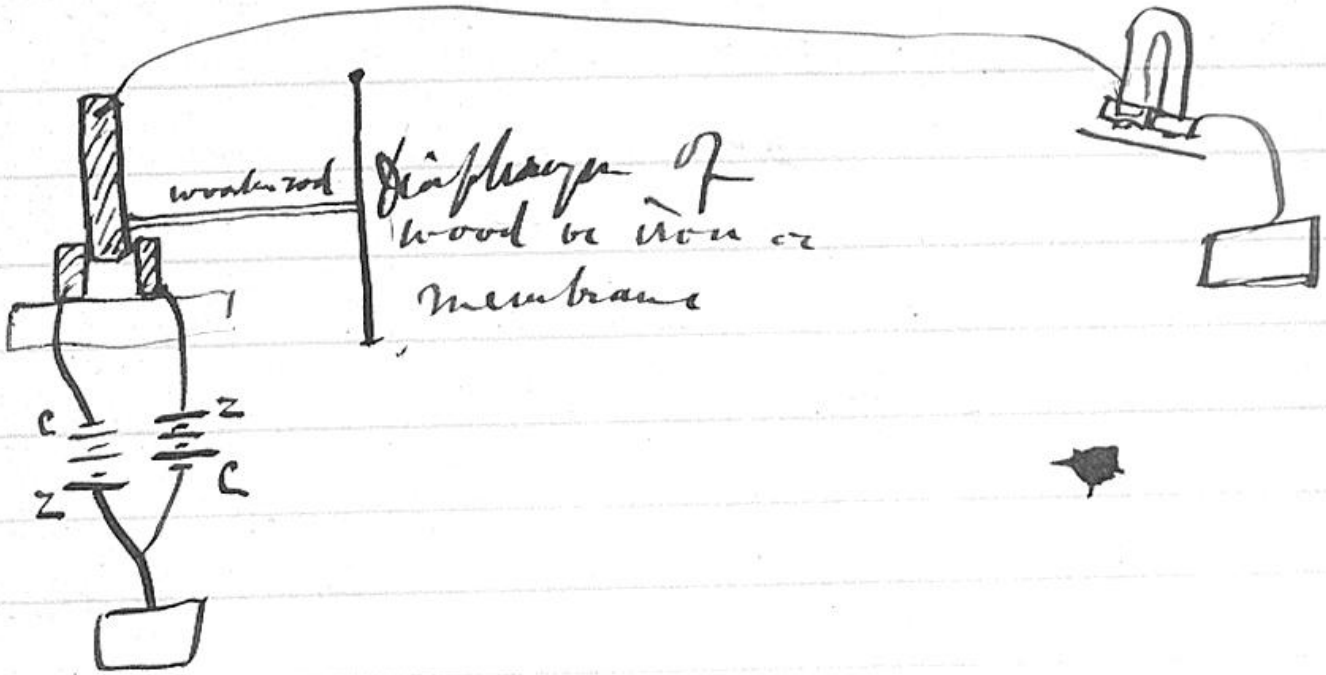
To obtain best effect reverse current — & attract / & repel armat.

How is this?



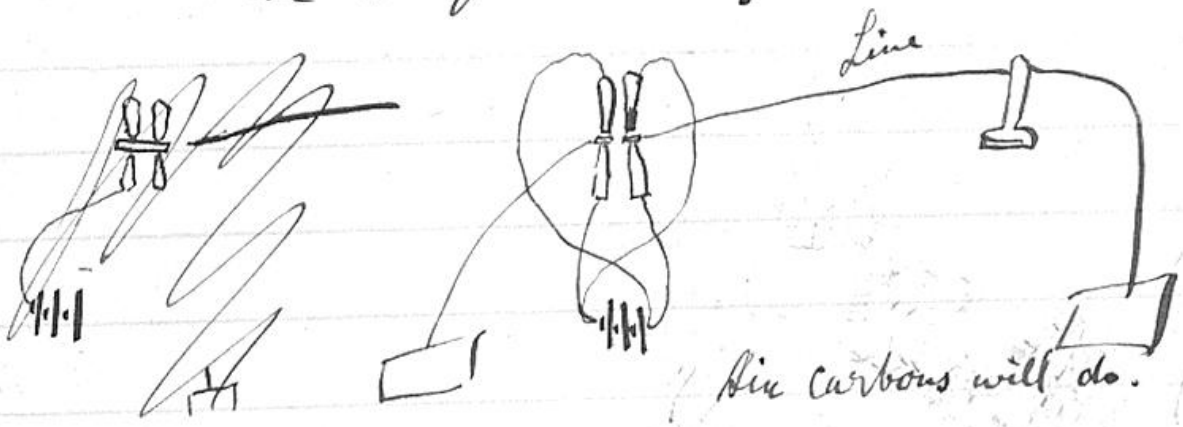
a b c carbons in light contact

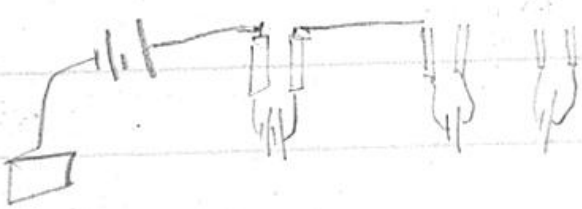
Perhaps attach carbon b to a diaphragm so as the sound sensitive to sound.



May 25th or 1878

Use single battery





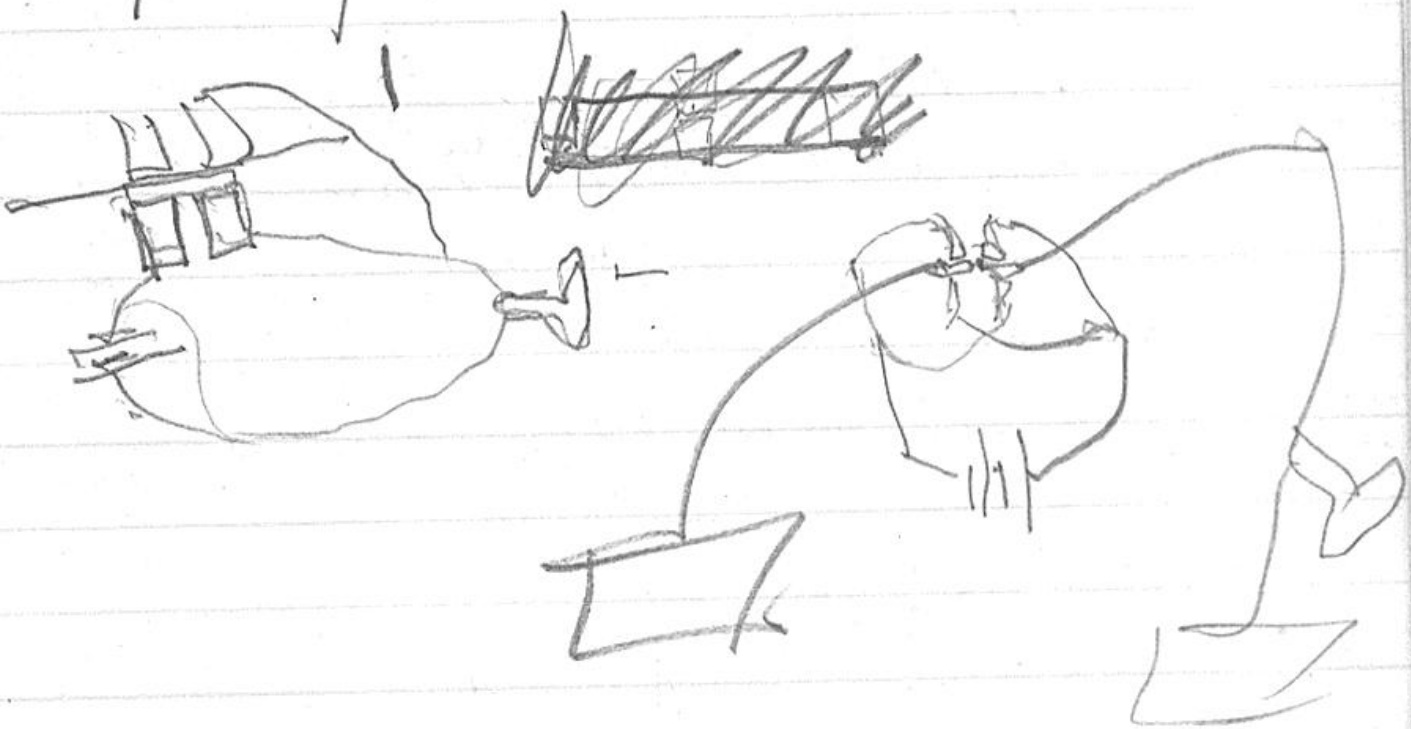
May 26th 1898 —

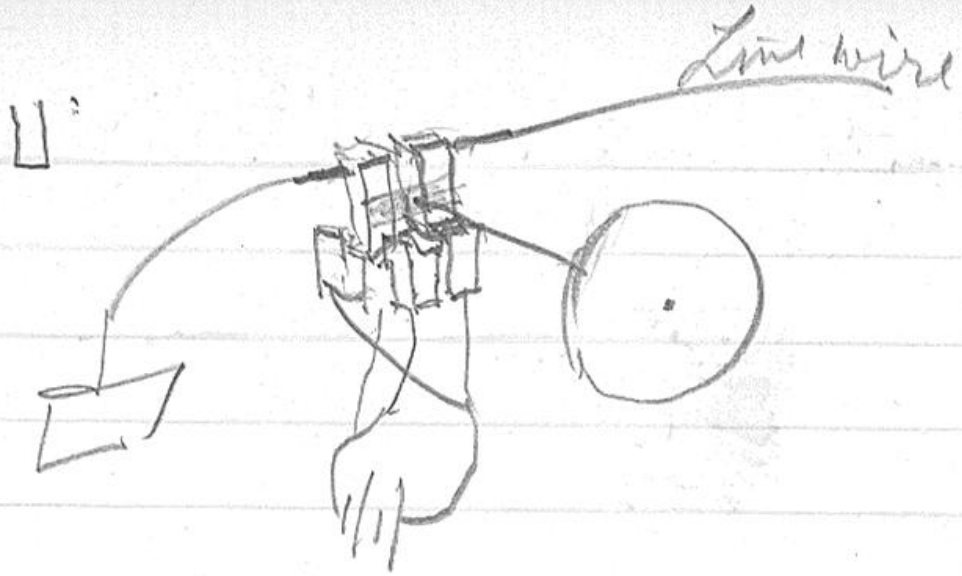
Mabel has decided to call baby — Elsie May —

Although the baby turns to the light (according to Mrs Hubbard) she is quite unmoved by any movement made near her eyes. A quick motion of the hand before the eyes that makes any of us wink seems to be unperceived by baby — at least the eyes remain open & no winking results. Shall observe when first winking from such a cause appears.

Dec 26th 1878 The Microphone
principle as Relay.

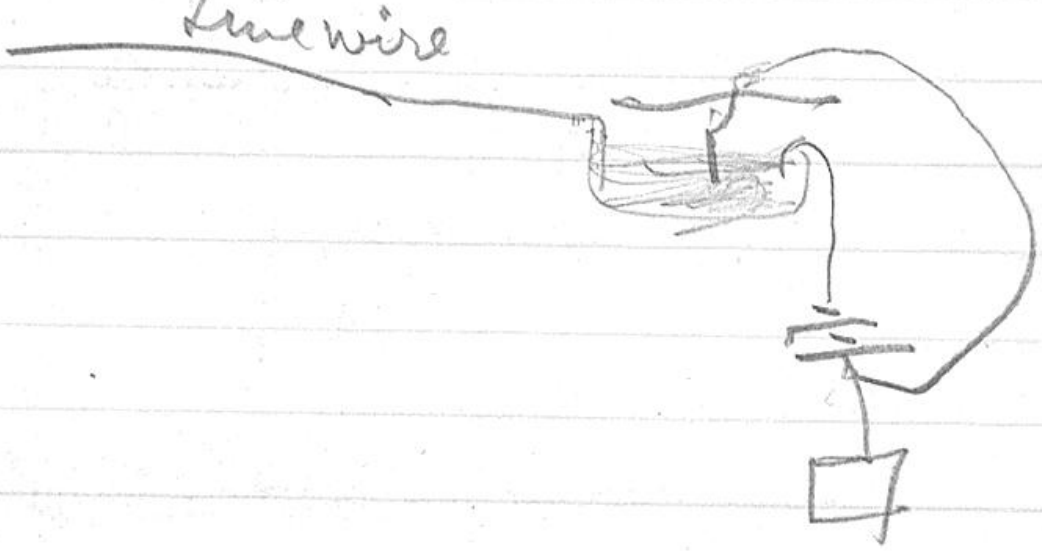
Tuesday Dec 27th, 1878

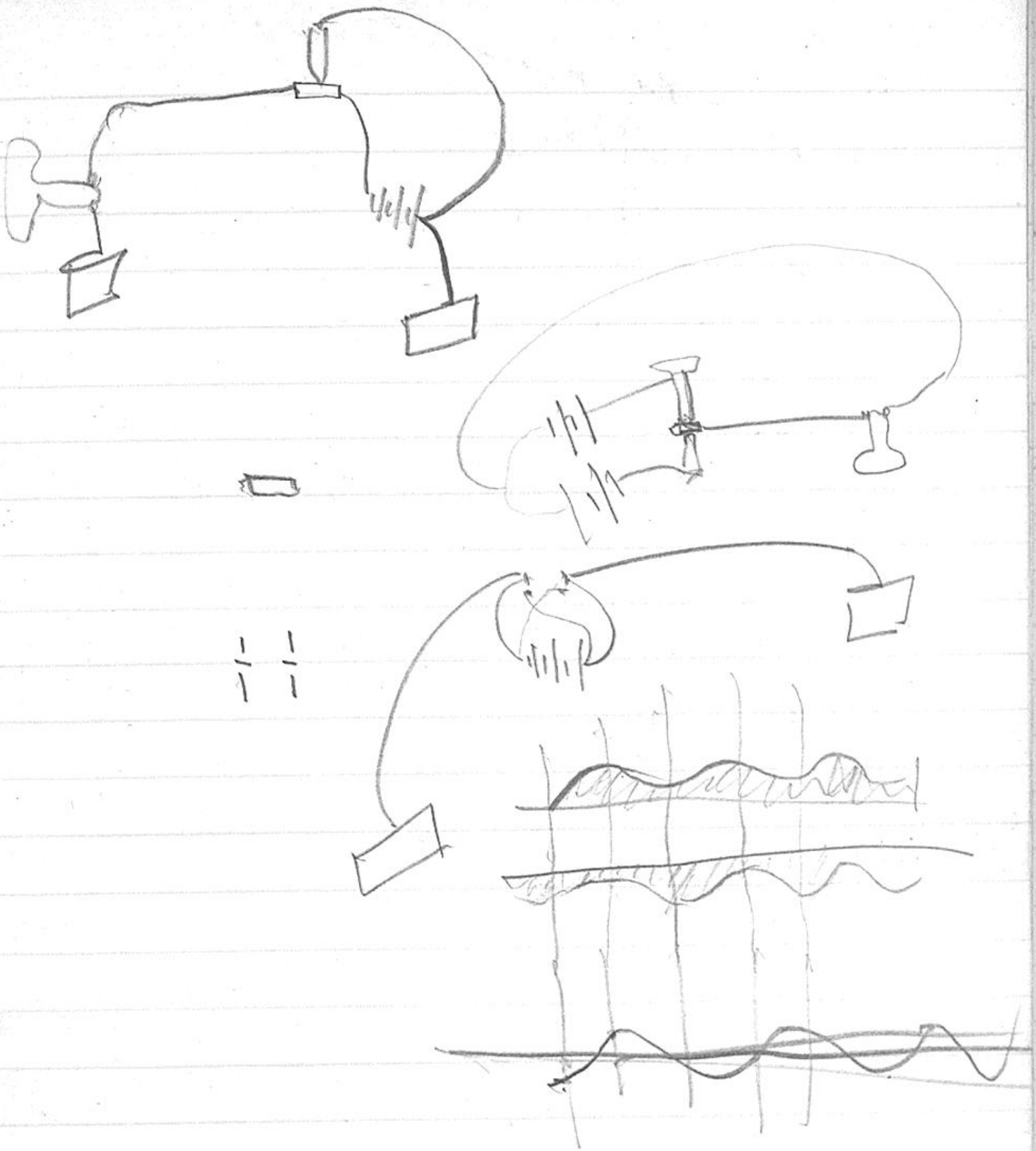




Why not use mercury or good conductor to short circuit in a greater or less degree.

For instance.





May 31st Mabel & Baby went for their first drive today.

Elsie weighed yesterday - result 9½ lbs
A gain of two pounds in 21 days

20) 7.5- (3
60
20
75- 4
75- 1/4 remy

Tonight read account of many infants being poisoned by the use of violet powder adulterated with arsenic. Chester tested the violet powder Mrs Freeman uses for baby and found it free from arsenic.

Mabel much affected by funeral of infant at No 72 on the way, she sent a bouquet of flowers to the mother as a token of sympathy. The mother (Mrs Woolf) evidently gratified at the attention — ~~[illegible]~~ sent her card to Mabel with thanks

Mabel Mrs Freeman, Elsie & I drove in a carriage in the Park & Rotten Row. Mrs Hubbard & Gertrude drove in hansom.

May 31st Can see clearly that study of laws of motion as applied to atoms will lead to most valuable results taken in connection with Conservation of Energy. Strike clear of all pre-conceived ideas. Dismiss idea of an attractive force. Consider all motion as the result of pressure and all pressure as the result of motion. Be guided by following principles.

Atoms can only move as wholes or rotate.

Ax. An atom can only be set in motion by the impact of other atoms. ∴ the sum of the motions after impact equals the sum of the motions before impact. Motions of all kinds are positive the positive or negative sign merely indicates the direction of the motion Thus +a and −a The sum of the motions = 2a the + sign indicates that the motion a is in the pos. direction and the − sign showing the opposite direction − but the sum of the motions is 2a −

June 5th. 1878 — Returned from Cambridge this morning (Wednesday) having been absent from home practically three days.

Sunday at Sherwood with Dr. Siemens
Monday at Oxford with Prof. Max Müller
Tuesday Cambridge with Prof. Clerk-Maxwell.

When I left Elsie on Saturday — no tears were visible when she cried. Today I find tears coming copiously. Baby was four weeks old today. No winking yet manifest when hand is passed before eyes.

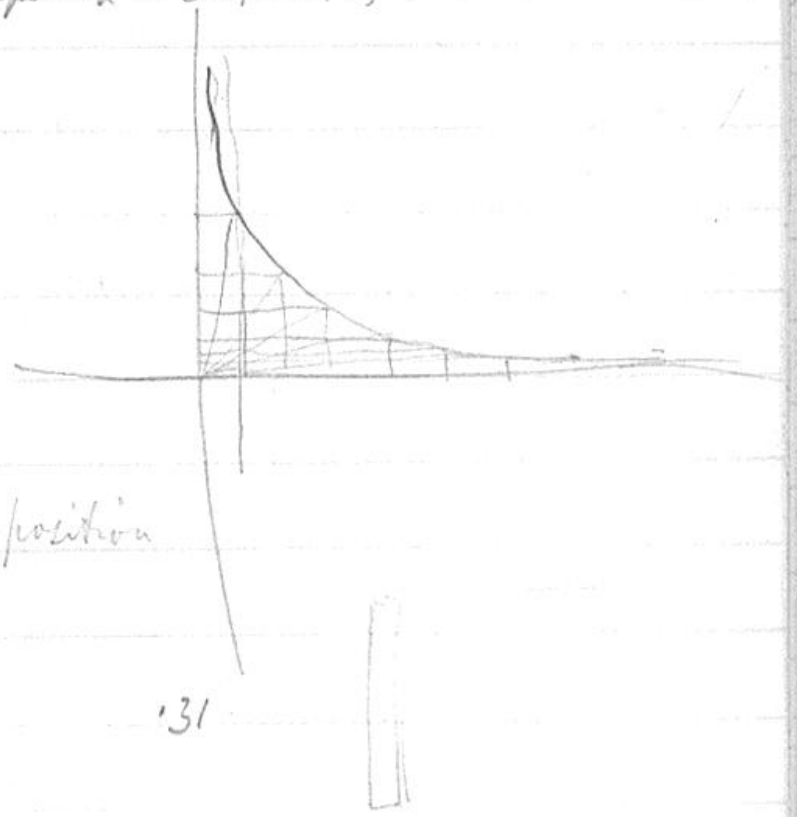
June 8th 1878 — Means of observations of deflection for localit of coil.

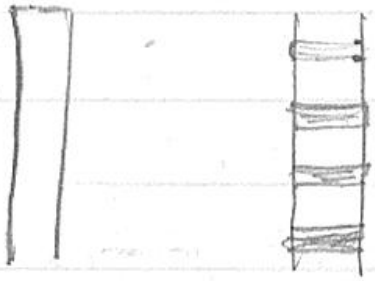
~~Log x expon curve~~

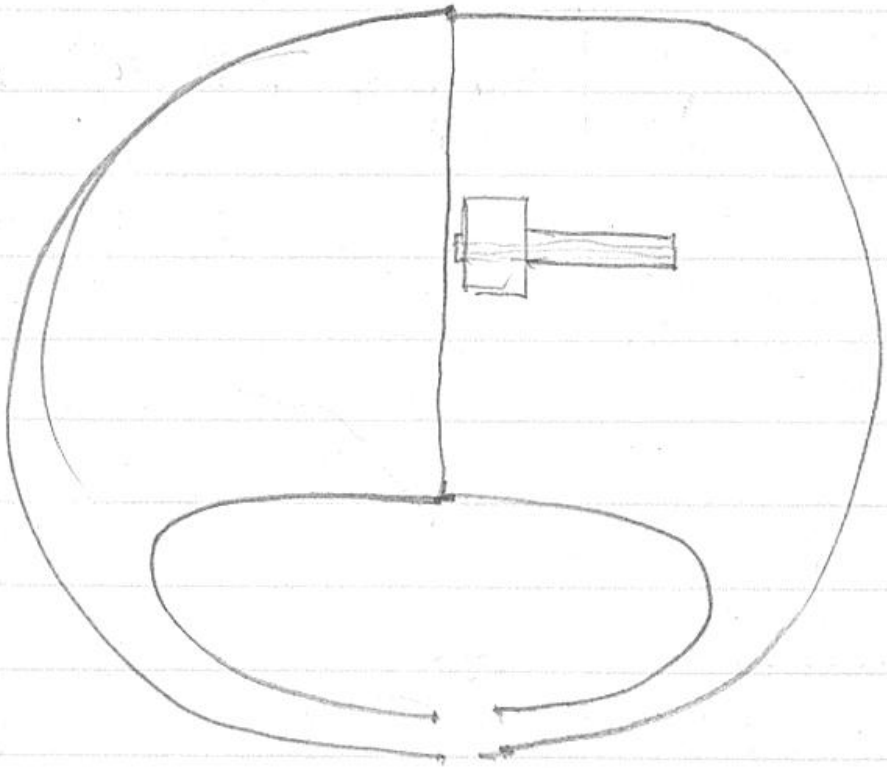
Take as origin the top of magnet — & take magnet itself as the axis of x — then y will be the deflection.

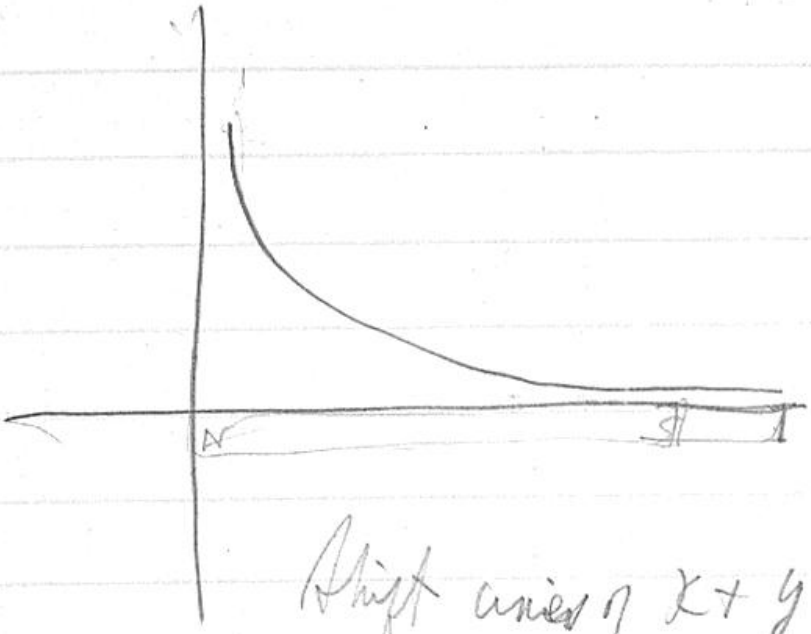
See pages 61 & 63. x = dist of centre of coil from top of mag.
y = deflect expressed in centimetres.

1.	$x_1 = 1$	$y_1 = 8.63$
	$x_2 = 2$	$y_2 = 5.72$
	$x_3 = 3$	$y_3 = 3.88$
	$x_4 = 4$	$y_4 = 2.52$
	$x_5 = 5$	$y_5 = 1.81$
	$x_6 = 6$	$y_6 = 1.23$
	$x_7 = 7$	$y_7 = .94$
	$x_8 = 8$	$y_8 = .67$
	$x_9 = 9$	$y_9 = .48$
	$x_{10} = 10$	$y_{10} = .31$
	$x_{11} = 11.15$	$y_{11} = .25$
	$x_{12} = 12.1$	$y_{12} = .20$
	$x_{13} = 13.1$	$y_{13} = .10$
	$x_{14} = 14.1$	$y_{14} = .09$
	$x_{15} = 14.9$	$y_{15} = .06$

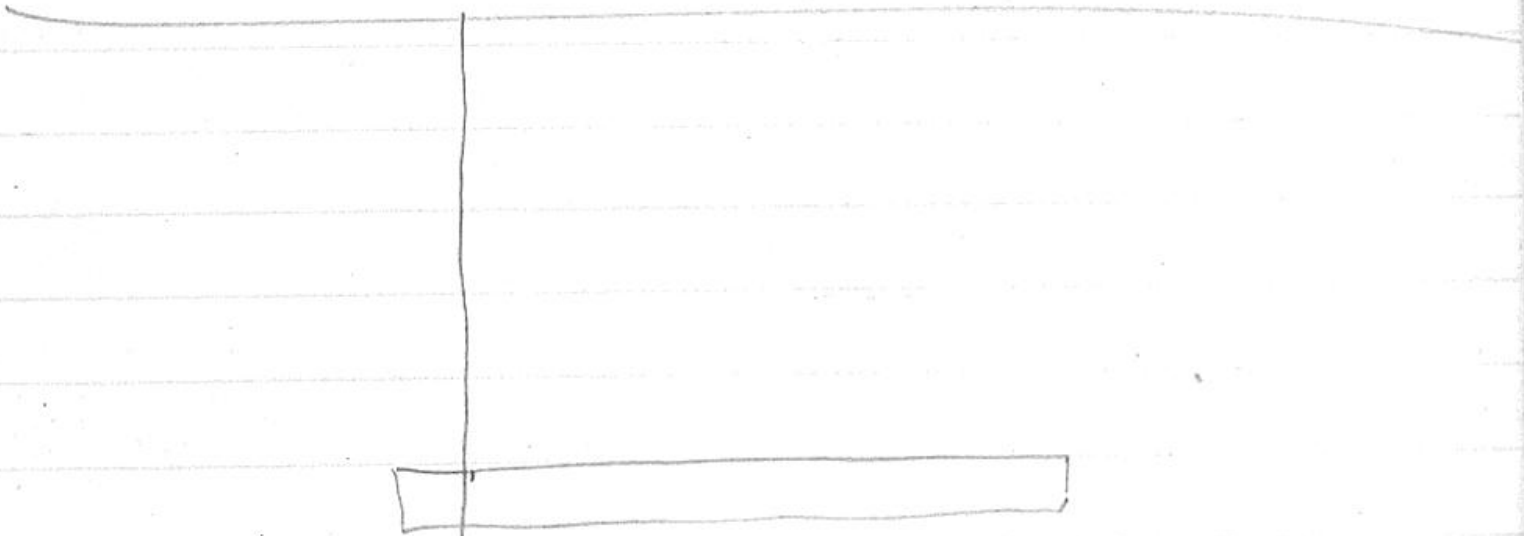








Shift axes of X + y so as to cut curve.



axis of y is 1.0 cm. from top of mag.
axis of X is 0.31 from line of magnet.
Revised elements of curve will be Therefore

~~Record the As of Curve referred to~~

New rectangular co-ordinates referred to the new origin

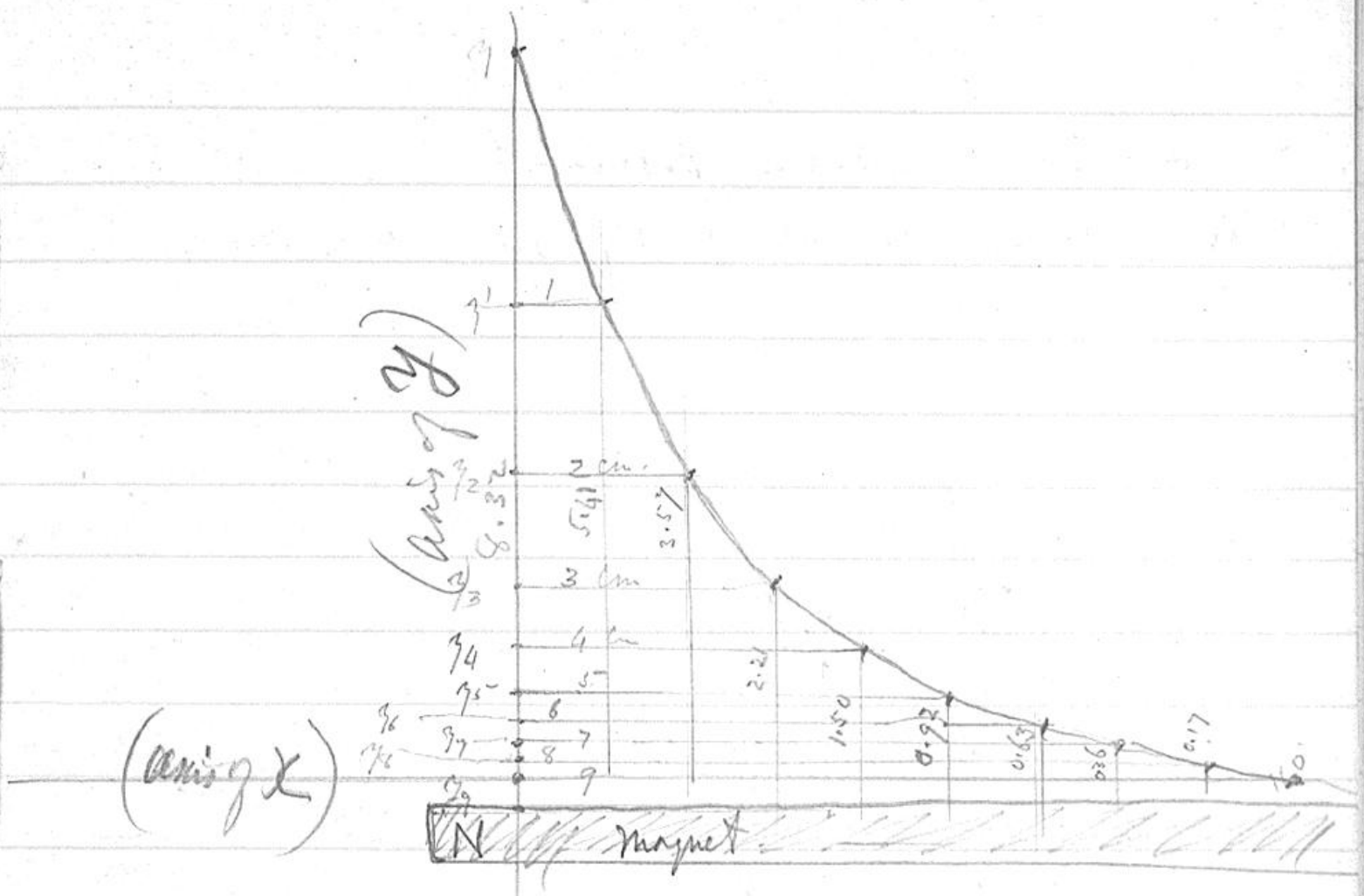
and :

$x = 0$	$y = 8.32$
$x_1 = 1$	$y_1 = 5.41$
$x_2 = 2$	$y_2 = 3.54$
$x_3 = 3$	$y_3 = 2.21$
$x_4 = 4$	$y_4 = 1.50$
$x_5 = 5$	$y_5 = 0.92$
$x_6 = 6$	$y_6 = 0.63$
$x_7 = 7$	$y_7 = 0.36$
$x_8 = 8$	$y_8 = 0.17$
$x_9 = 9$	$y_9 = 0.00$

$x = 0 \quad y = 8.32$

$x_1 = 9 \quad y = 0$

$x + a + y + b$


(axis of y)
(axis of x)
y
y1
y2
y3
y4
y5
y6
y7
y8
y9
1
2 cm.
3 cm
4 cm
5 cm
6
7
8
9
5.41
3.51
2.21
1.50
0.92
0.53
0.30
0.17
0
N
Magnet

June 9th 1878. Want money. Seems to me I can immediately make a valuable sale by perfecting Hotel annunciator shown in old book page 42. & subsequent pages.

In place of having a large number of springs as at page 45 & one tooth to push them out. Why not have a number of fixed wires & one spring to touch them alternately. Think this out.

But this tooth on page 45 makes one circuit & at the same time breaks another. This is important.

Principle is all wires united through a common magnet. When a circuit is closed mechanism is released & each wire is alternately tried ~~to see the~~ seeking for a tooth makes contact with it

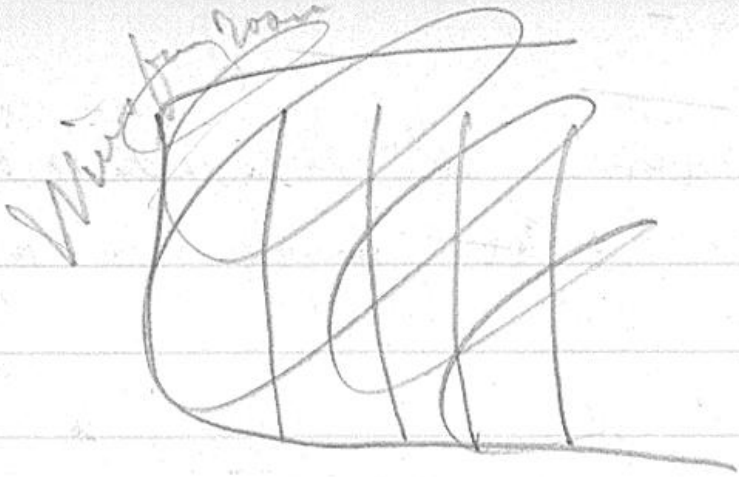
each wire alternately but the same time by breaking connection with common magnet.

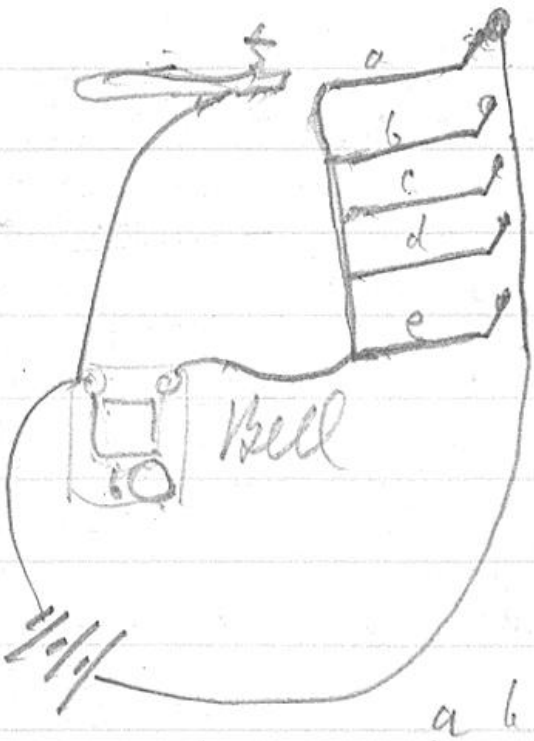
New principle.

Unite all wires with common electrical bell. When a circuit is closed. Bell rings ~~& sets wheel~~ ~~going~~ mechanism revolves & each circuit is broken successively. When proper circuit is reached — ~~wire &~~ bell stops ringing & revolution stops. Pointer then indicates the proper line.

One magnet required. Perhaps not necessary to break circuit at all. Only short circuit magnet with each wire alternately.

Golden Chain over page.





Let a b c d e be wires from rooms in hotel. Let the switch of a be turned so as to complete the circuit. Bell rings. Now take holder & and apply it to the wires a b c d or e successively. When applied to a the current will pass by & & bell won't ring.

Stupid!! The holder & would short-circuit bell & plant on any of the wires a b c d or e,

Suppose known that each circuit was broken alternately at the points 1, 2, 3, &c. Then breaking circuits ~~at points~~ b d or e at points 2 3 4 or 5 would not stop bell ringing when position of affairs is that indicated in diagram but breaking circuit a at point 1 would at once stop bell.

Won't do — for you could discover nothing if two circuits (say a & c) were both closed in succession at same time. Plan a little faulty if only one signal is made at a time is not practicable see nothing better than old plan.

Perhaps simple plan might be.
When signal comes disconnect all
wires from return & then test
each separately.

This is good idea.

Work out.

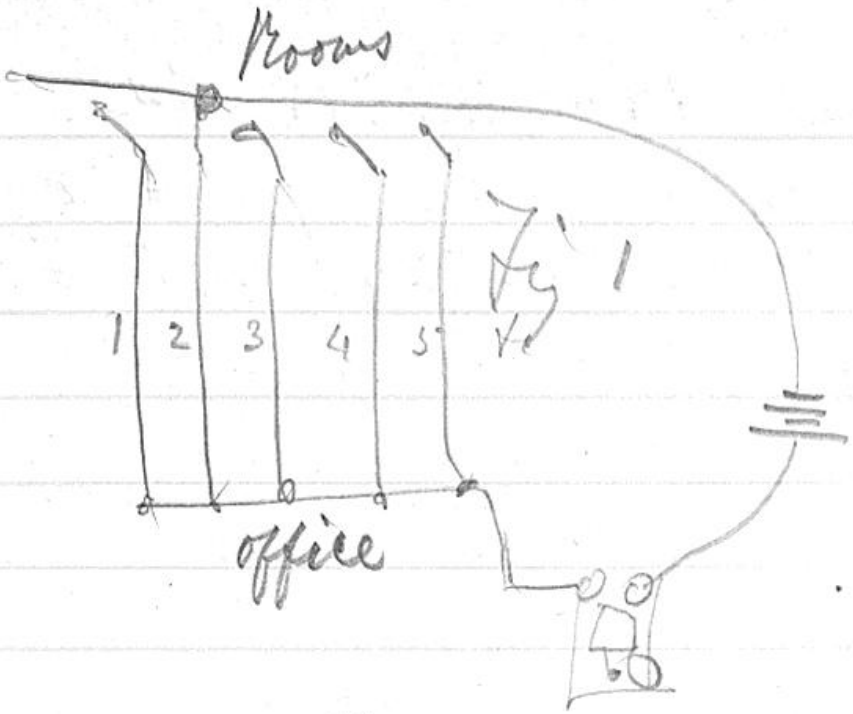
Idea in embryo is here.

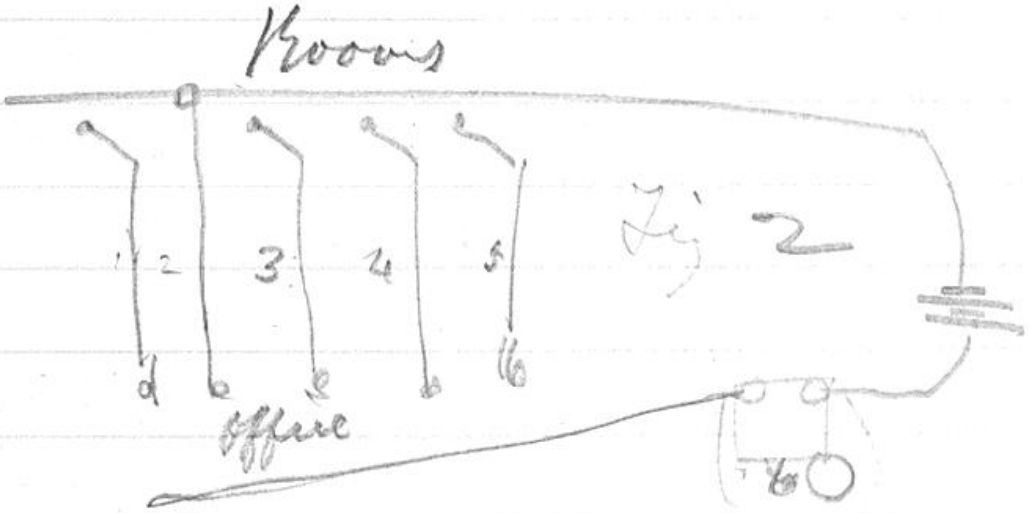
Suppose Fig 1. represents original condition
of wires. Bell rings.

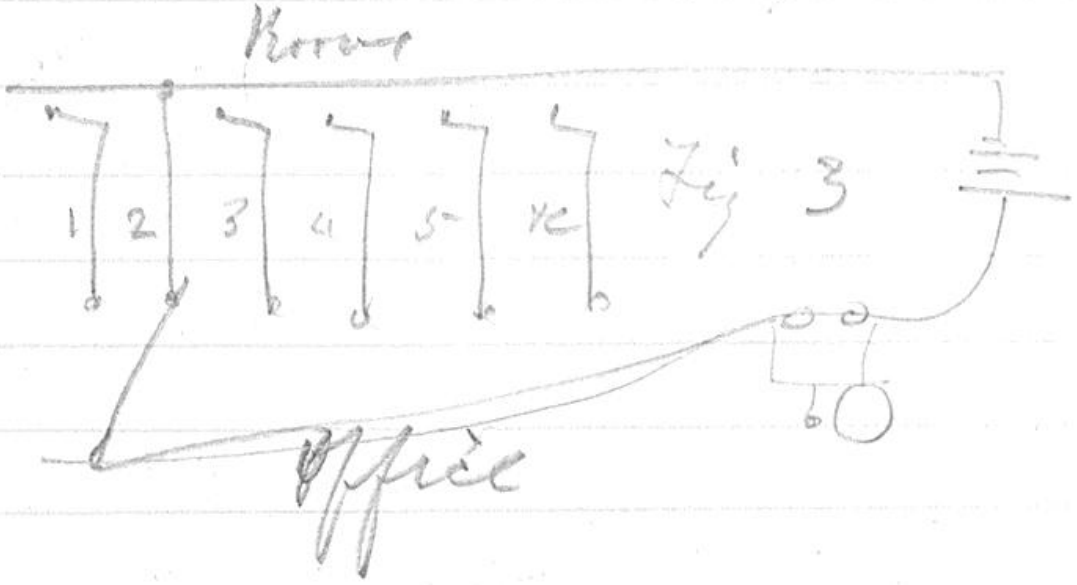
Fig 2 Wires disconnected. Bell
stops ringing.

Fig 3. Bell wire connected with
each wire alternately. Bell
rings when connected with No 2.
Signal therefore proceeds from Room 2.

So this process automatically
& problem of economical annunciator
is solved.


Rooms
1
2
3
4
5
Yc
Office
Fig 1


Rooms
1
2
3
4
5
a
b
c
d
e
f
Office
Fig 2


Rooms
1
2
3
4
5
Yc
Fig 3
Office

June 10th 1878 — Annunciator idea most important especially if it can be applied to Central office system.

But must be applicable to magneto-call arrangements & closed circuits.

There therefore two conditions.

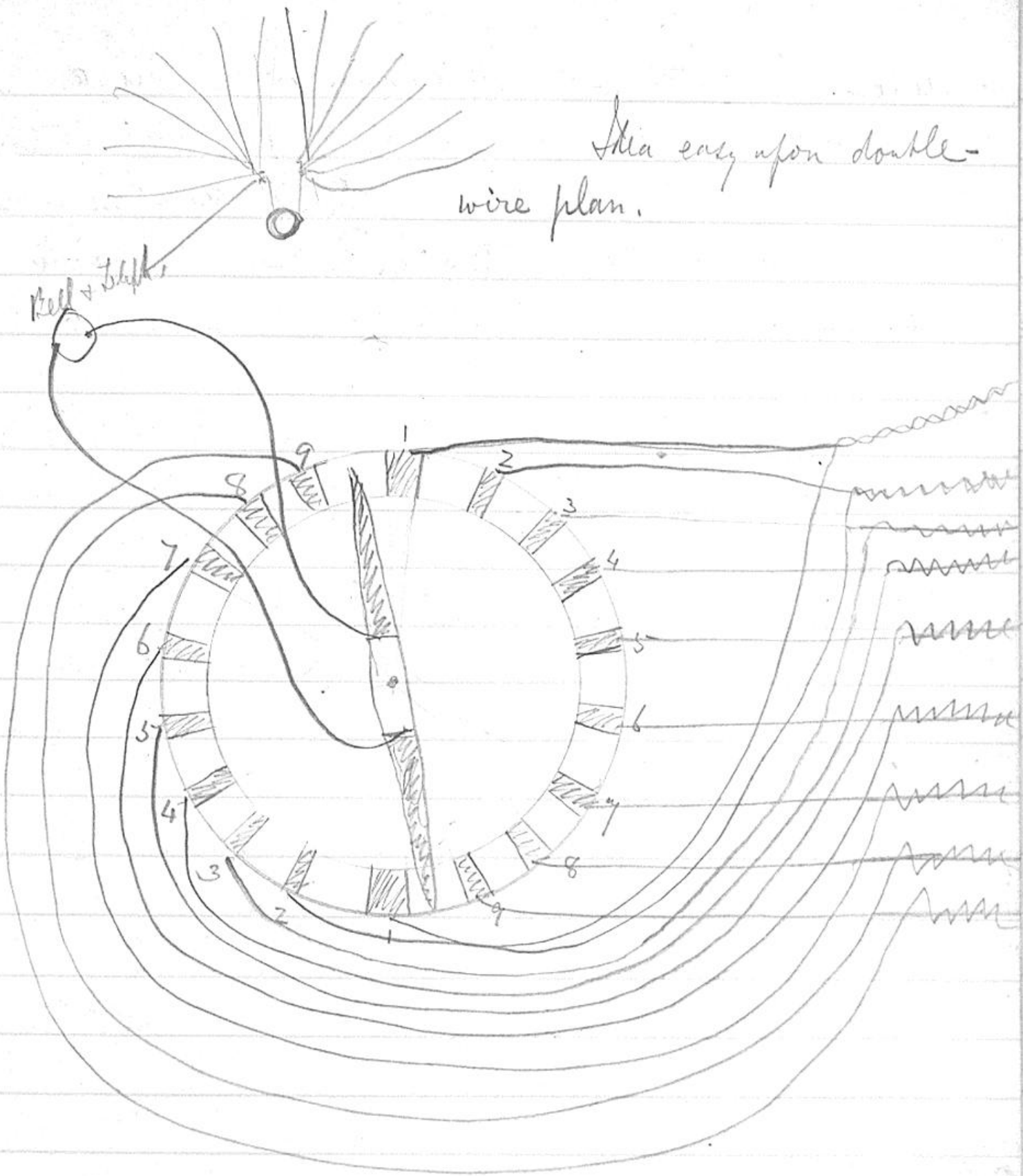
1st. Where it is only required that the Central office be called so that the number of the room or house calling be known. x —

2d. Where the central office can call the various rooms or houses as well as they call it.

1st Plan most economically solved by permanently open circuit. 2d plan must have closed circuits

Solve 1st plan first then consider 2d.

Over



Also easy upon double-wire plan.

Perhaps Hotel arrangement can be made wholly automatic & electric — by accomplishing rotation of "finder" by the step by step motion of armature of electro-magnet — thus obviating the necessity of clockwork.

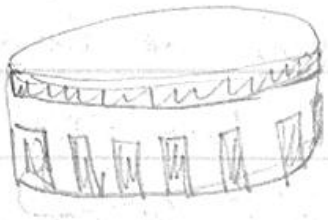
Pass magnet under iron armatures. When proper armat. is reached let magnet attract armature & hold it firmly.

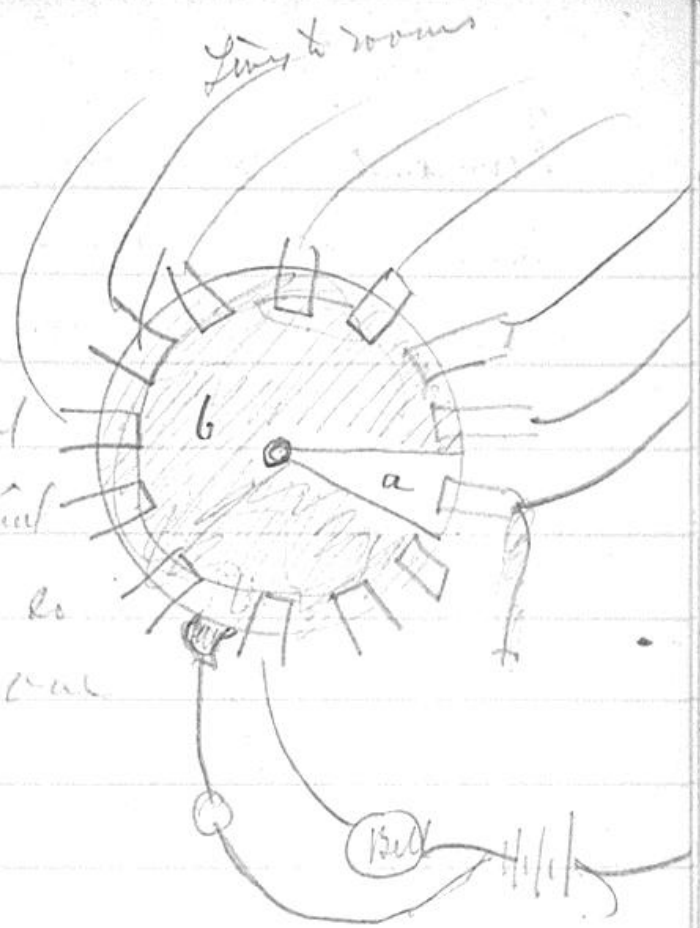
Not so good as keeping magnet fixed & mech. making contact with each wire separately.

See nothing better in principle than old arrangement excepting that perhaps the details may be simplified & improved.

(See old book page 45)

Edward Cyphers

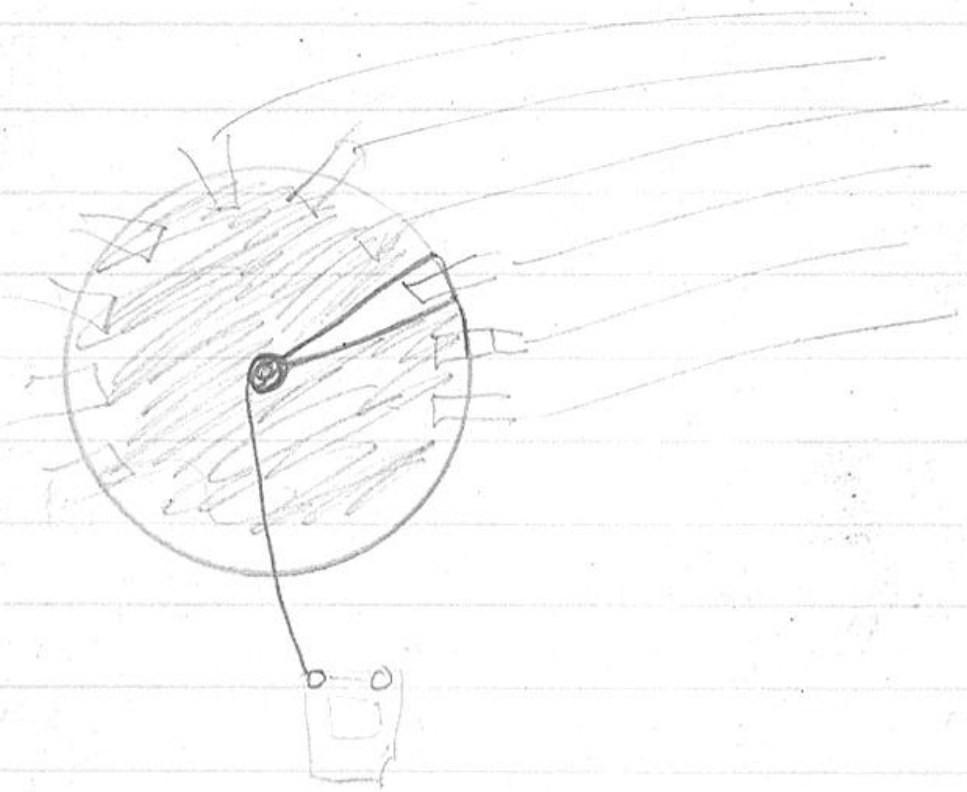




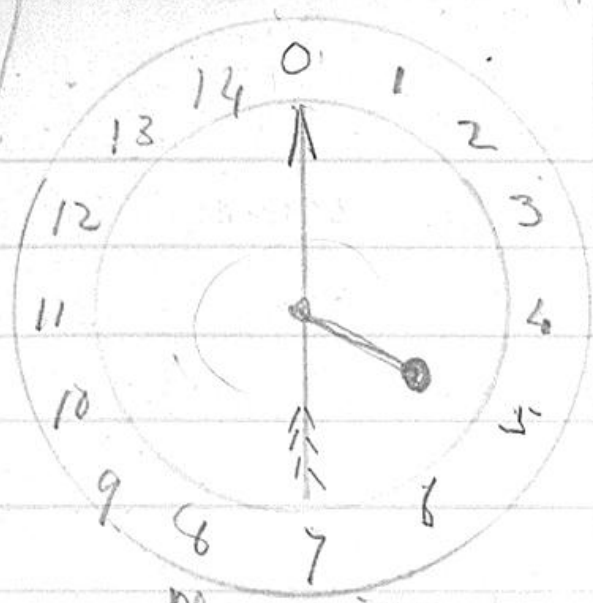
Two circular metallic disks (a × b) placed face to face with insulating material between. Upper disk cut away so as to expose lower disk at one part a.

Ans.

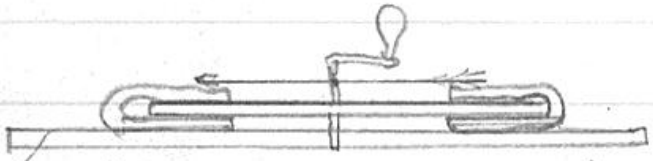
Simplest for house where only one bell would be touched at a time would be break circuit when pointer comes to right ~~Closet~~ room.



Hand-Indicators for Houses.



~~Plan~~ Front view.



Sectional View

June 11th For better make the
Indicator automatic & independent
of clockwork.

Make Electro-magnet work
ratchet wheel round & when proper
hour is reached - ring a bell.

June 12th

June 12th Baby! Baby!

Mrs Freeman our nurse left us
last night & baby cried all last
night & this morning. Mabel kept
no sleep. Terrible time for
for both of us. Mrs H. relieved
us early in the morning.

June 12th. In considering collisions of atoms it is evident that the case that atoms moving in the same straight line impinge directly upon one another they must exchange velocities. But however atoms may strike one another — their motion could split up into direct & tangential efforts

~~Thurs June 15~~

Monday June 16th. 1878

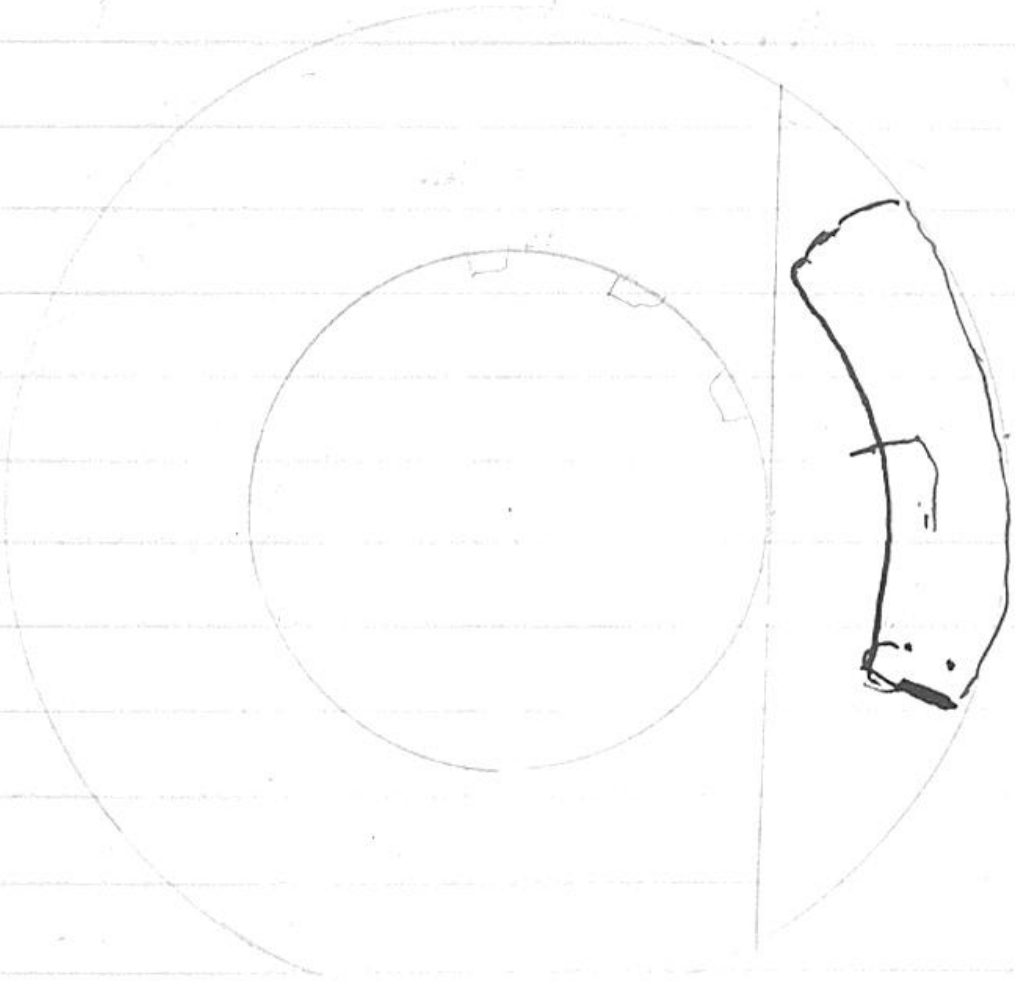
Returned from Plymouth this evening with Berta. Found Mabel in tears ~~[illegible]~~ and Elsie ill.

Poor little baby as white as snow - looking seriously ill.

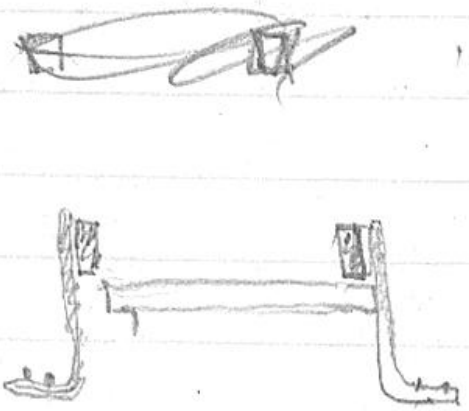
~~[illegible]~~ went for Mrs Freeman but she was not in. Doctor does not think it serious.

Tuesday June 17th. 1878

Baby moaned all last night. Took her usual food this morning still unwell. Doctor says pressure on the brain due to excretary functions being out of order - does not think it serious. Mabel much troubled. Mrs Freeman has been with us today but leaves tonight. Thinks baby has caught cold. New nurse engaged. Came tonight. Baby seems brightening up.



Tuesday June 17th 1878. Arranged with Mr Bailey to make Hotel Indicator of old model with clock-work. Think that model can be simplified.



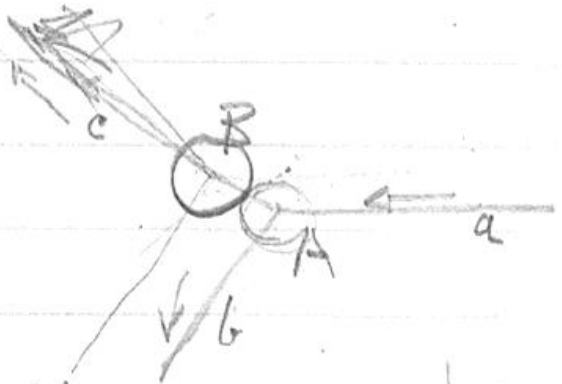
January 5th 1878 Atoms.

Take following Statements as correct: 1st Conservation of energy (which defines as momentum).

2. Atoms impinging on one another directly exchange conditions.

3. Composition & resolution of forces.

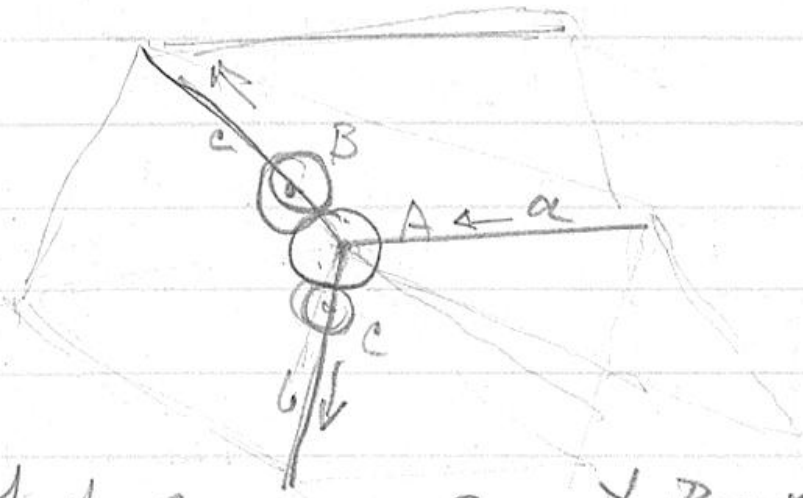
Let ball A impinge upon ball B at an angle of 60°



The motion a considered independently of mass is equiv. to motions b + c.

But while mass is considered — the conserv. of energy demands that $Ma = M'b + M''c$ where M M' + M'' are the masses of the bodies driven along the paths a, b, & c.

Take above case but let A strike two other atoms at rest, so that A will remain at rest and B & C go on moving:

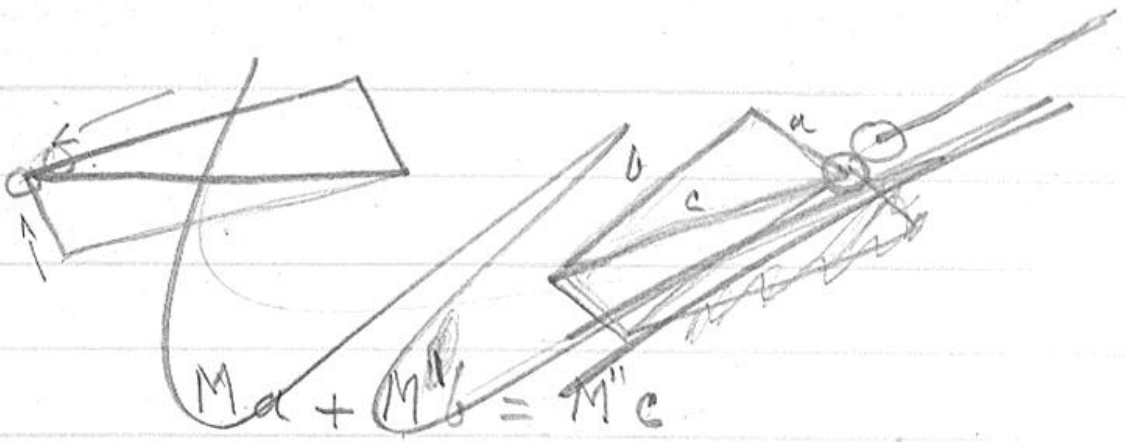


Angles 60°. What masses must B & C have relative to A to go on with the same velocity as A. Let M M' M" be the masses & V V' V" the velocity. Then $MV = M'V' + M''V''$ as $V = V' = V''$

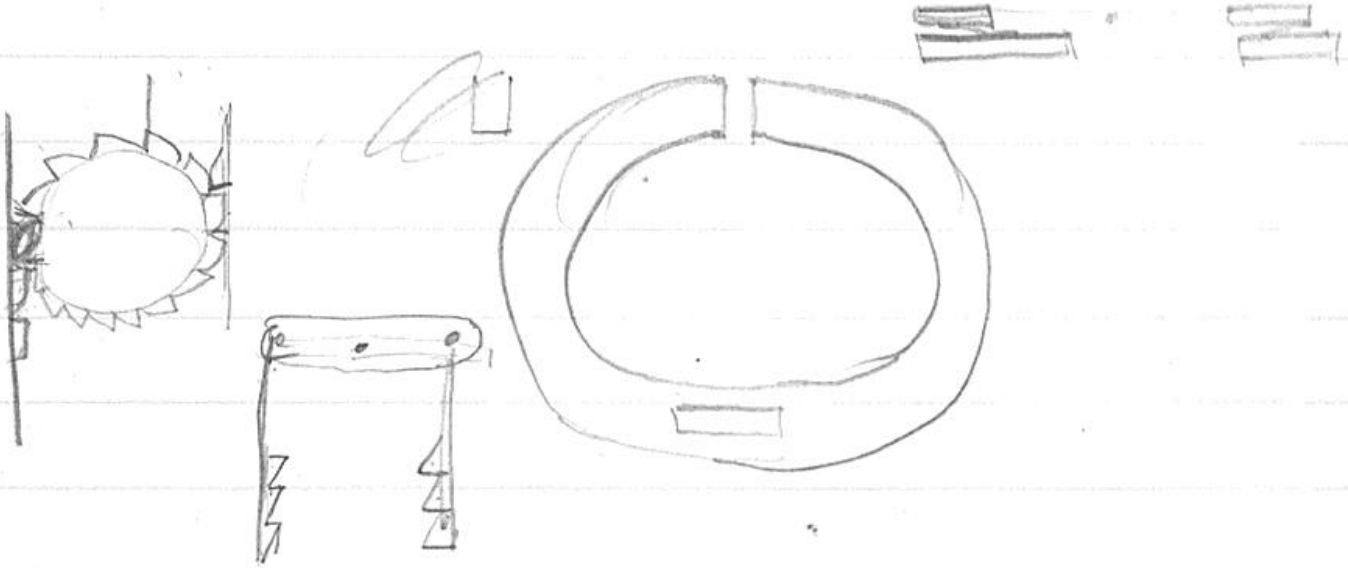
~~Inverse where~~

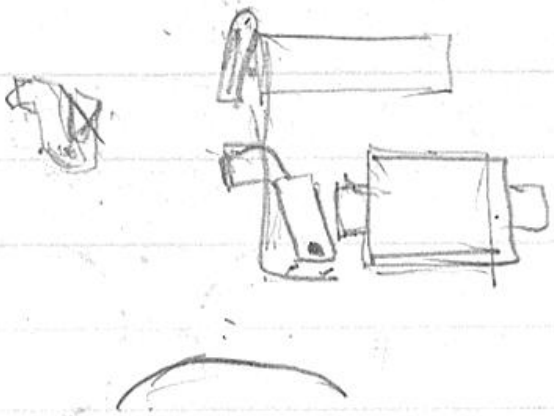
Query will not $M' : M'' :: V'' : V'$

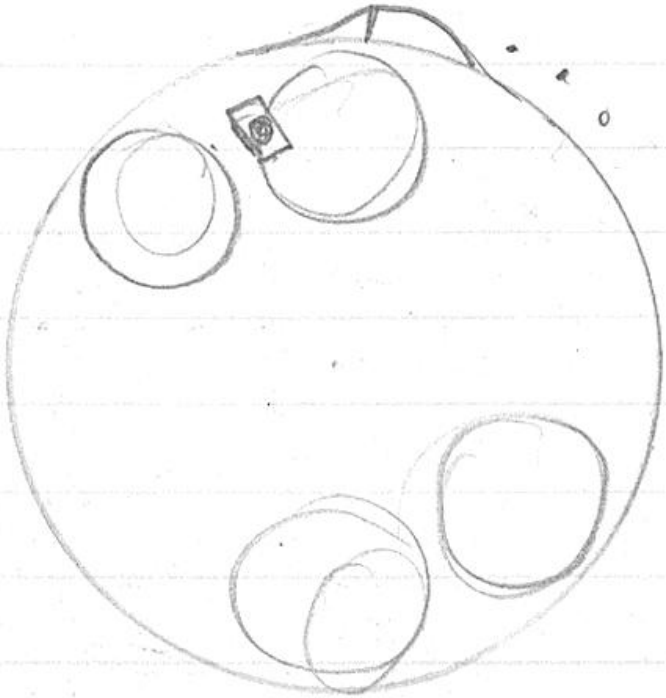
If this is so $M'V' = M''V''$ This surely could not be a universal rule excepting when angle is 60°.

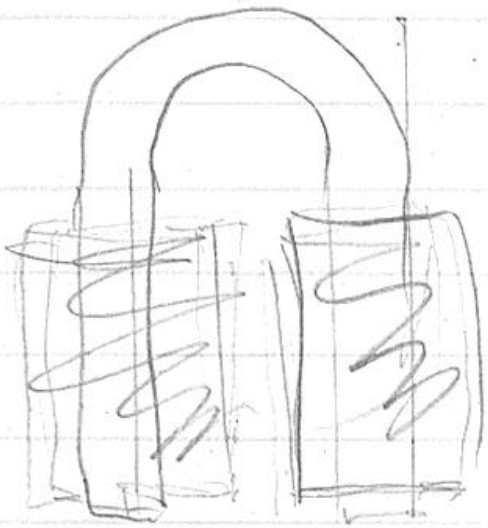


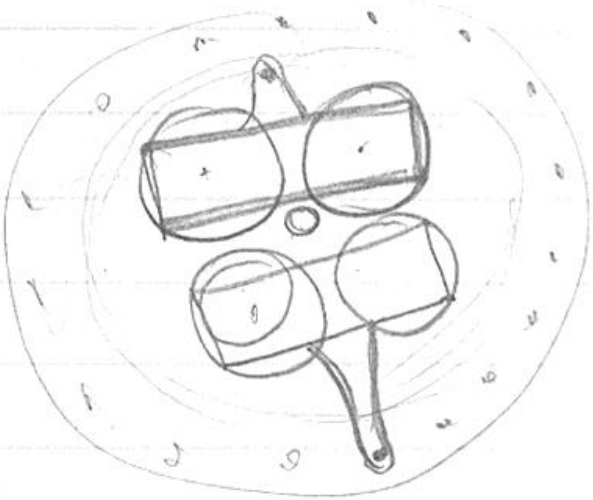
Can see that difficulty of atomic collisions can be completely eliminated by considering masses.



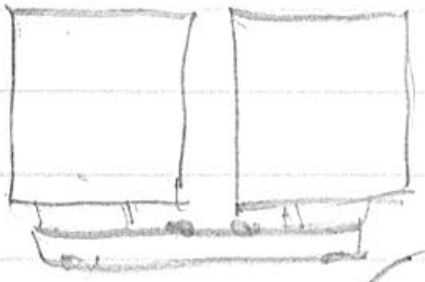


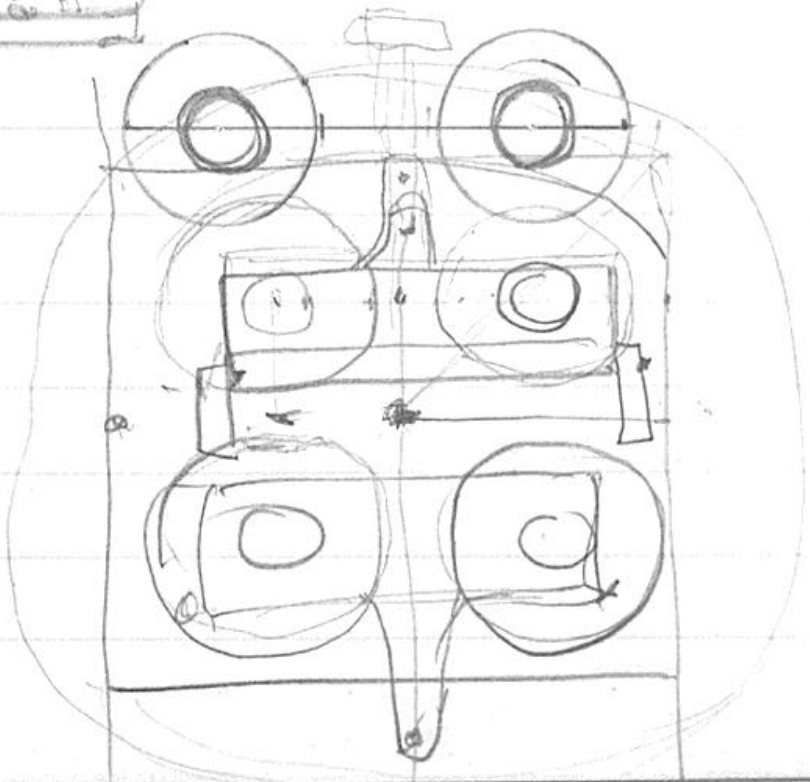


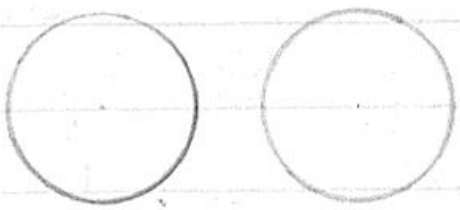


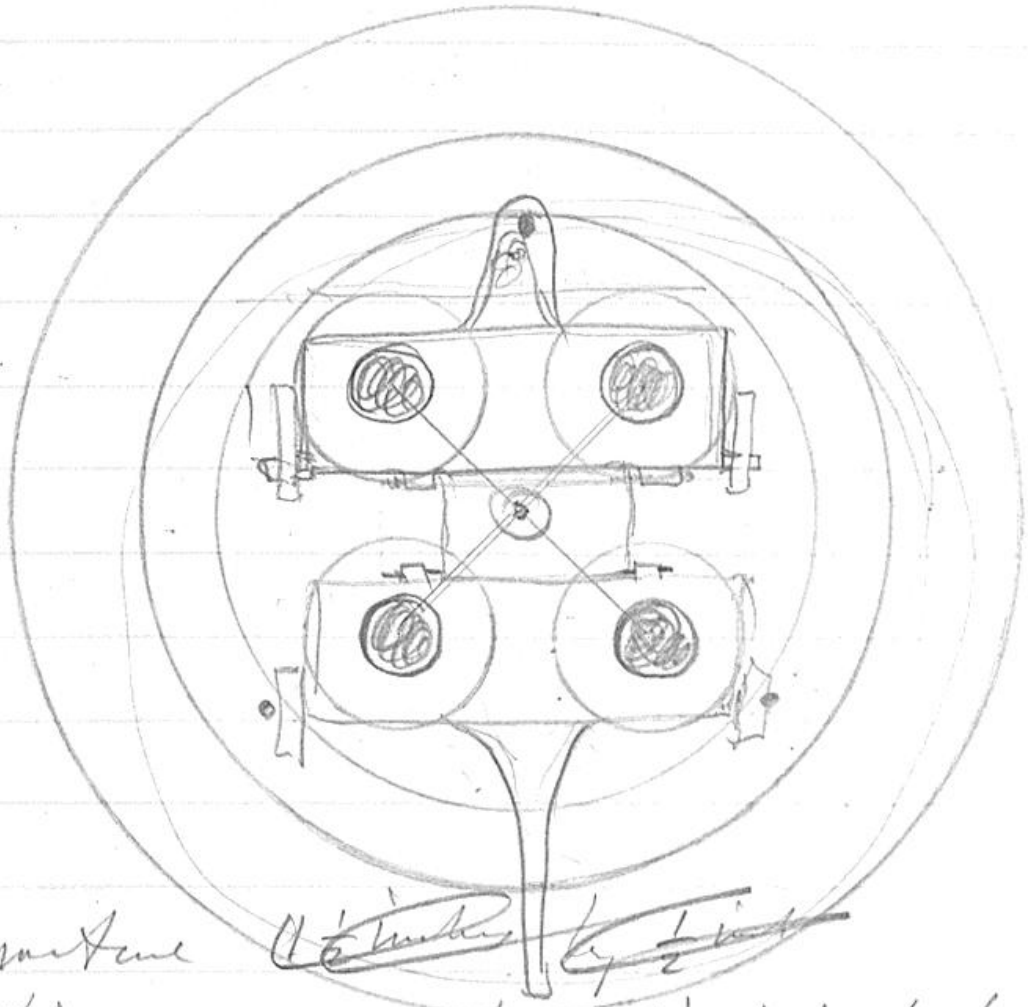


$\sqrt{2}$



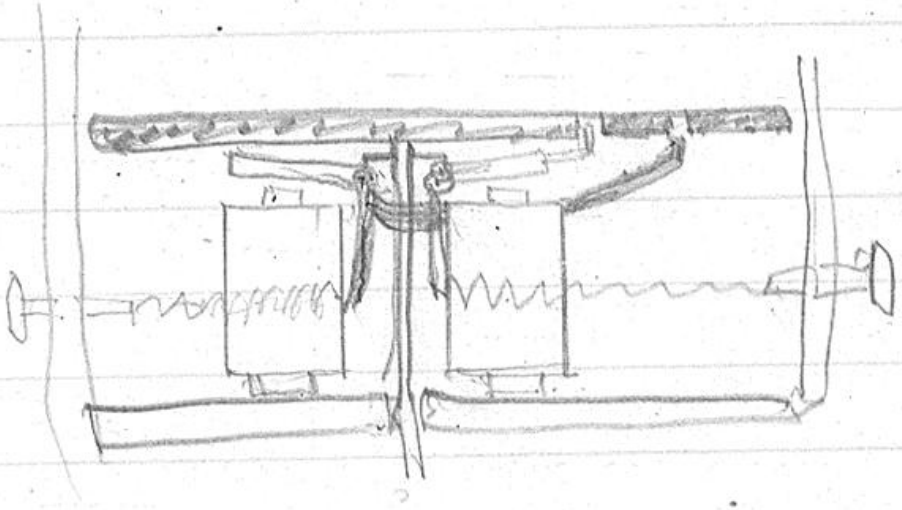


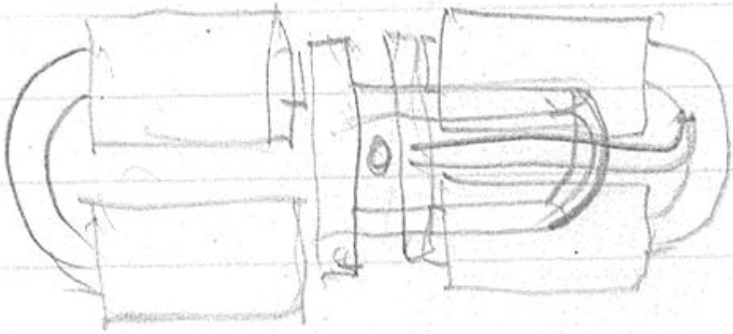


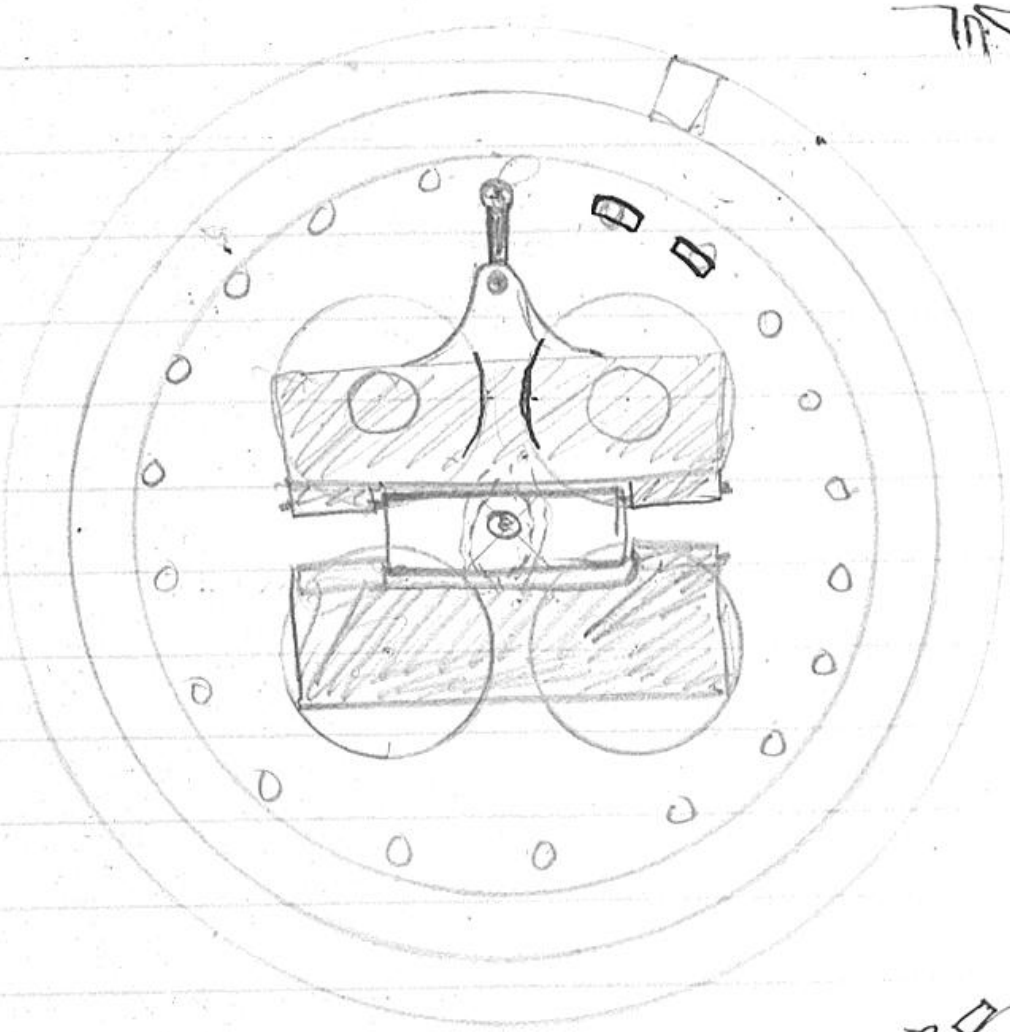


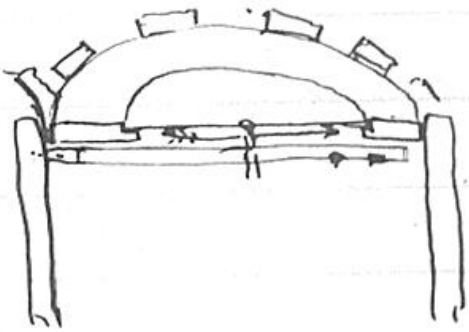
Armature ~~6 by 1/2 by~~

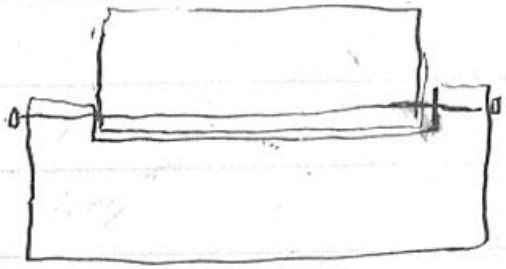
Dimensions of armature 1½ by ½ by ⅛

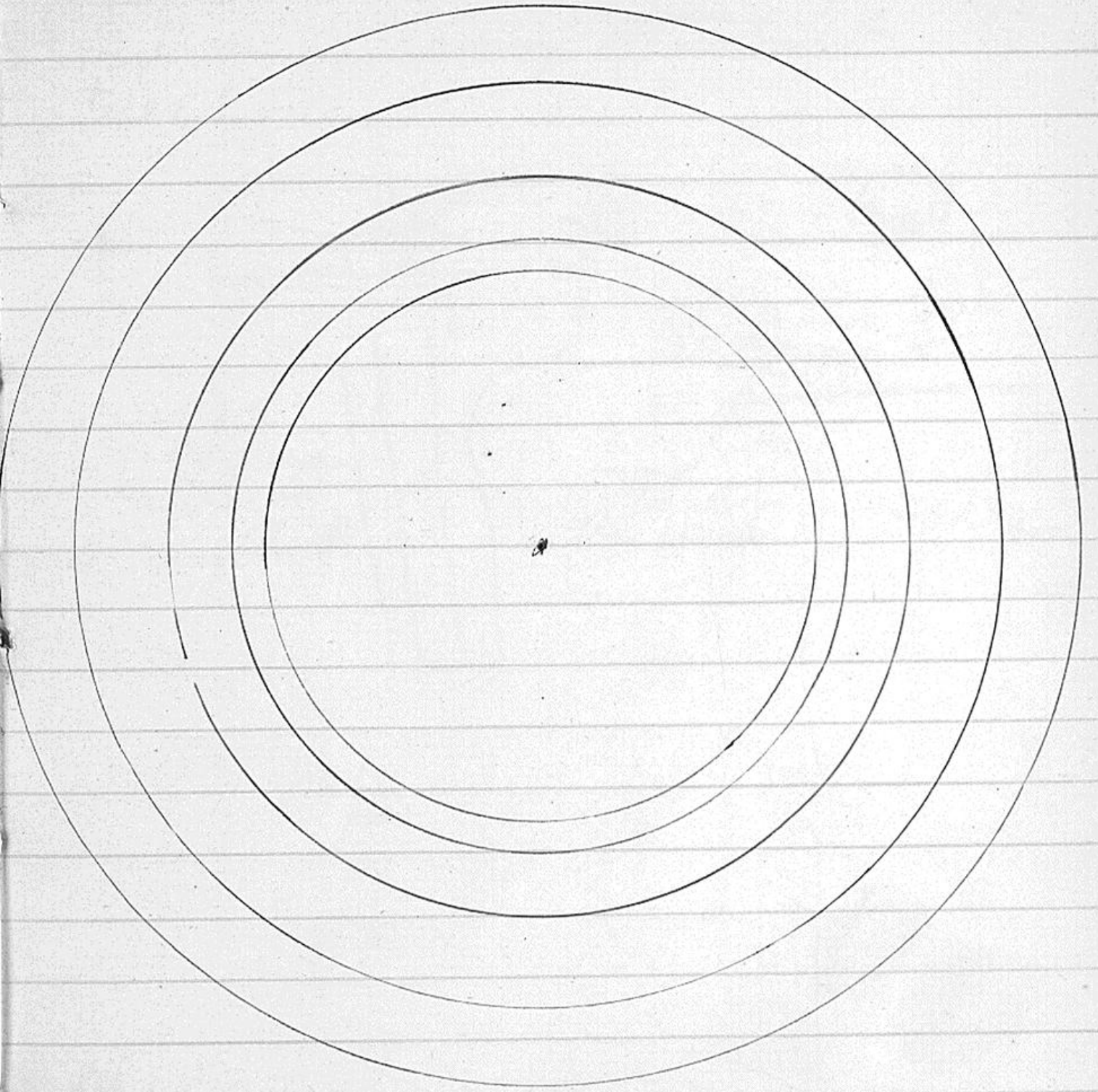




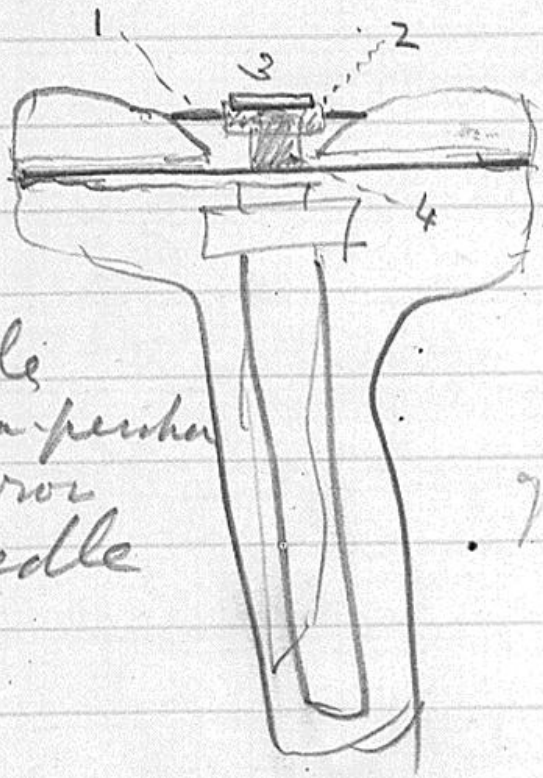




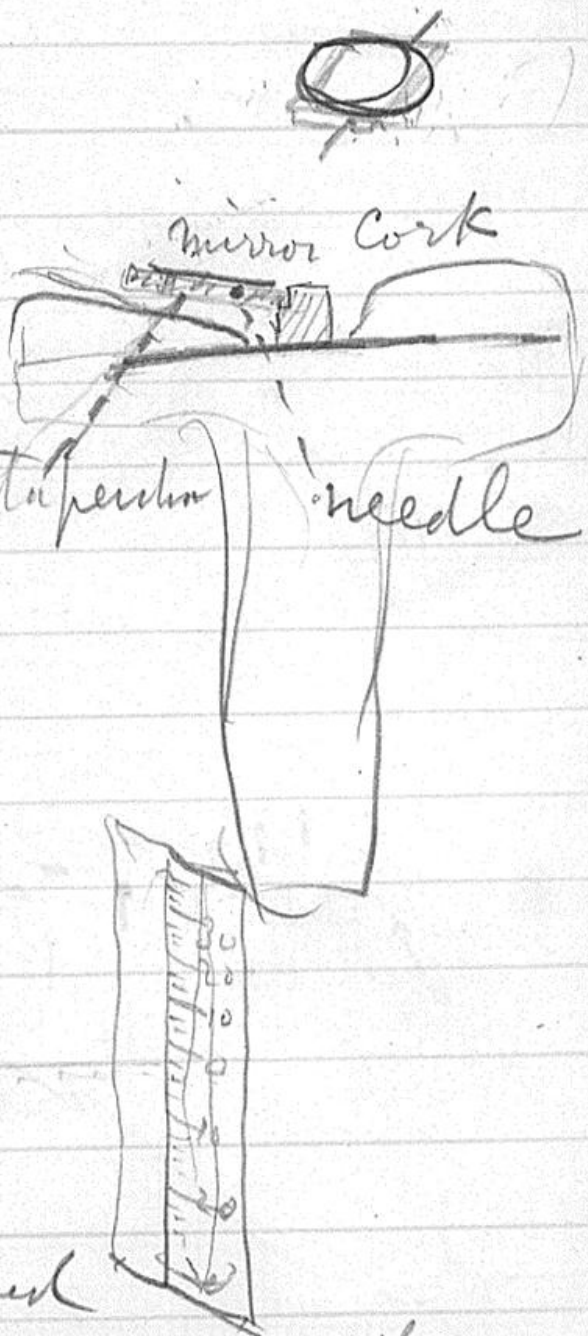




June 30th 1878 — Electro-phonoscope.
Made following attachment to a telephone.

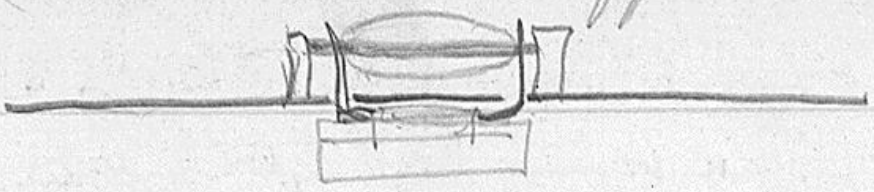


1 needle
2 gutta-percha
3 mirror
4 needle

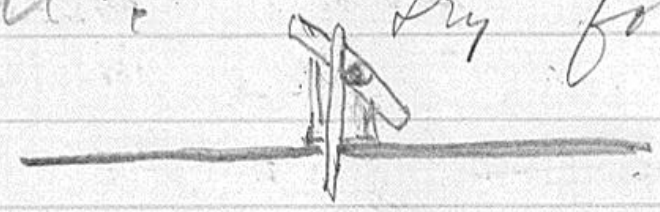


When current was passed through telephone. The scale apparently moved upwards a very little. This is sufficient to show

that more delicate apparatus will

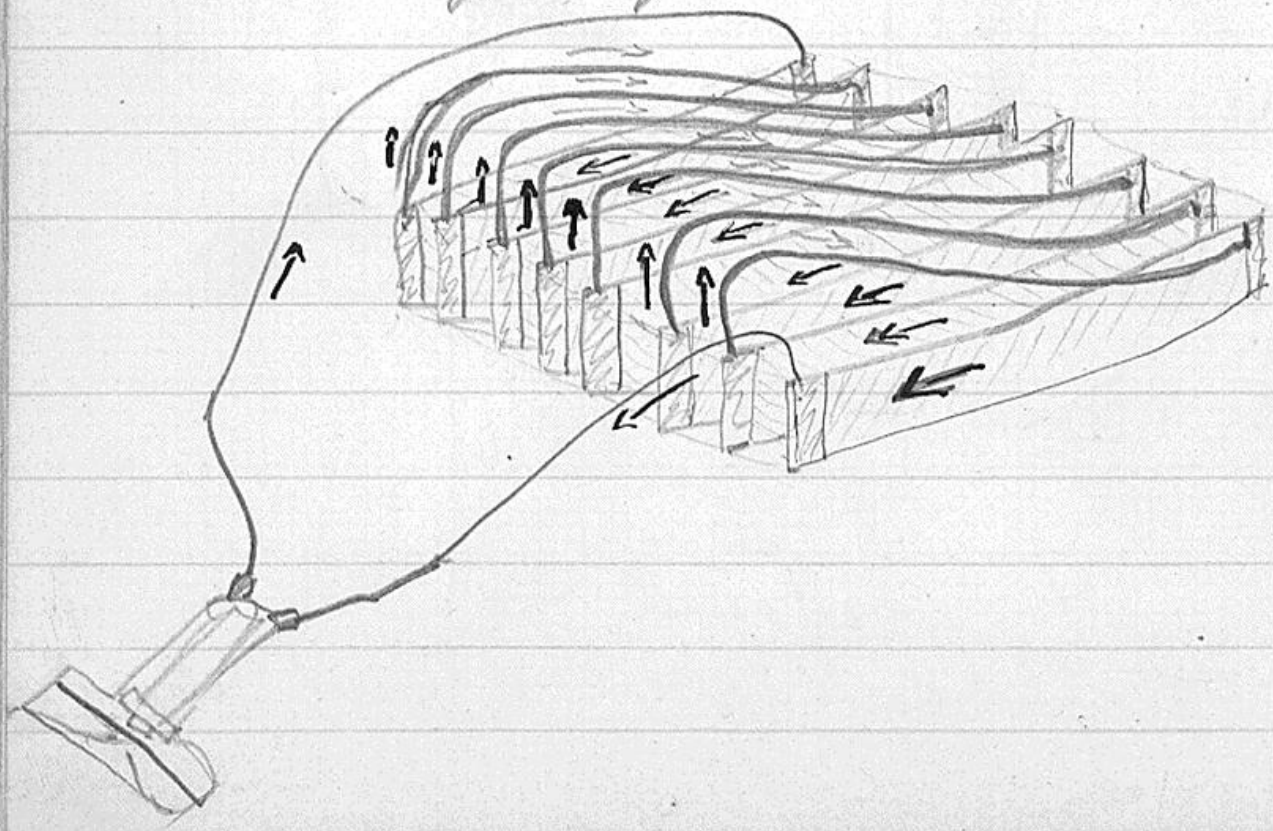


do well. Try following!

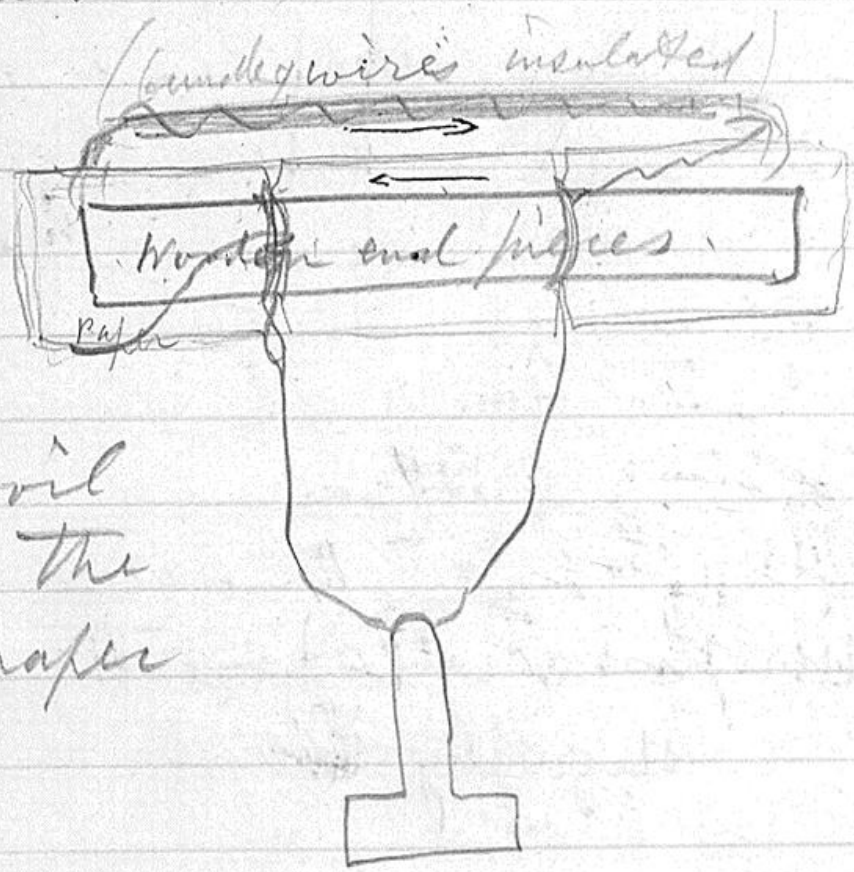


Turn mirror by friction against axis

Made this evening apparatus to test whether direct + return wires ~~can~~ neutralize induction currents when direct + return wires are of unequal resistances.

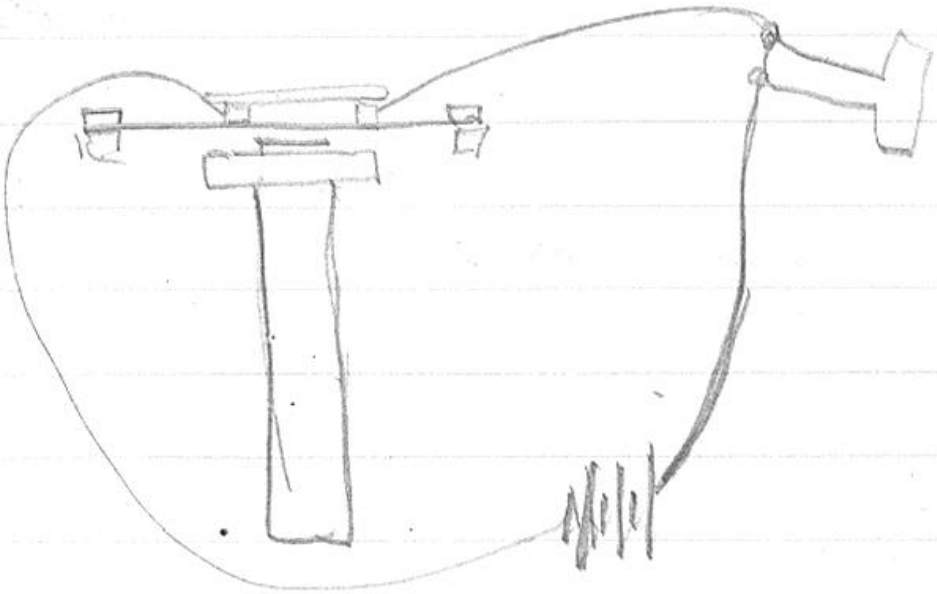


Direct wires of copper very thin (No 36) silk covered. Return wires of tinfoil each layer being 18 inches by 2 inches. These were arranged as in last diagram. Each layer was insulated from the next by a sheet of paper. Whole arrangement as follows.



Tin-foil between the leaves of paper

July 1st 1878 Why not
magnify sounds due to Earth currents
by placing microphone on Telephone-plate
? Thus :



Why not solve Autograph & Torpedo-
Boat scheme.

Microphone will make the solution
of Multiple Telegraphy if good
arrangement can be secured for causing musical tone
to record itself.

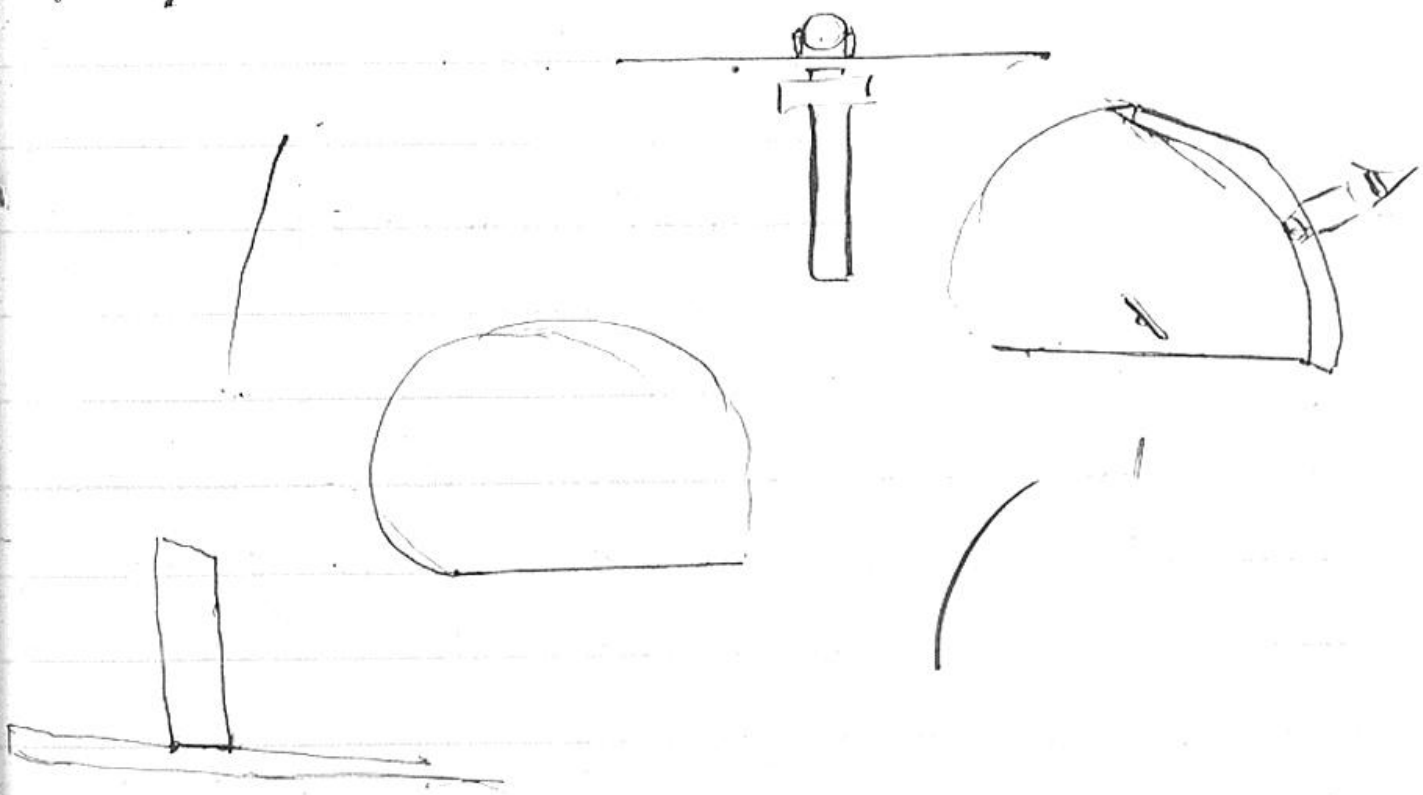
For autograph why not [illegible]
arrangement as this with induction coil

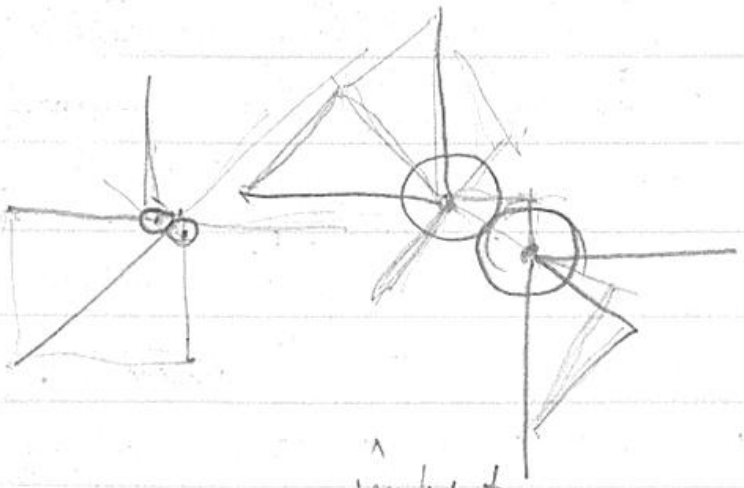
~~Hearing~~ It seems to me that power will be gained if sound is received upon a telephone plate & analyzed afterwards.

Take old concertina reeds & see whether we can play them by influence of telephone plate.

I like the valve idea for automatical registration.

July 4th 1917





Consider Boat as in same straight line & consider effect of mass. Then when impact impacts at angle are considered — split

&

July 18th A.D. 1878. The first anniversary of our wedding. We have been spending the past week at the Abercorn Arms Hotel, in great Staunmore but today Mabel & I accompanied by Elsie & Bessie went to town for the day. Mabel & I spent day in searching for wedding presents for each other.

I gave Mabel a set of the Aldine edition of the British Poets in 52 volumes & she gave me Chambers' Encyclopedia in 10 volumes.

In the evening we went to Muskegon & Cooke's performance in the Opera House, Mary Horne was quite startled to see how much baby has grown. Baby now tumbles occasionally — and evidently notices things in motion. She watched Gertrude's feet from a long time yesterday. No winking of the eyes yet when I stand in front of her. She evidently recognizes her mother.

Jan 12th Registered baby's birth today

$$P = A + W$$

$$P' = A + S$$

$M = P - P'$ Equals moving force.

When sled is up $P = A + W$ and $P' = S$ $\therefore$ $M = A + W - S$

When sled is down $P' = A + S$ $\therefore$ $M = W - S$

Express S in terms of W. Let $S = xW$

Then Sled up $M = A + W - xW = A + W(1-x)$

Sled down $M = W - xW$ $W(1-x)$

~~Suppose upward pressure $a_1(-)$ and downward pressure $a_2(+)$~~

Case Let S be Zero

~~Case Let S be~~ Coincides $S = W$

$S = (W + x)$

Then $M = A + W - (A + W + x)$

$= -x$ or N

Consider downward pressures upon reed as (+) and upward pressures as (−).

Then moving force may be considered as the resultant of all the pressures upon reed or (1)

$$M = P + P'$$

where M represents the moving force and P + P' the ~~upward + downward~~ downward + upward pressures respectively.

But $P = A + W$ atmospheric pressure plus pressure due to the weight upon air reservoir

And $P' = -(A + S)$ i.e. Atmospheric pressure and upward pressure due to the upon elasticity of reed.

As upward + downward pressures are antagonistic we better express one in terms of the other as much as possible so consider $S = (W + X)$

Then $P' = -(A + W + X)$ In this case

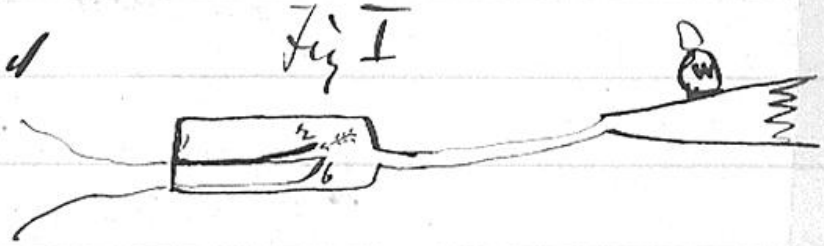
X = the difference between the downward pressure due to weight upon airbag − the upward pressure due to the spring of the reed.

There are two cases that must be considered in ascertaining moving force. (1) Forces in operation when reed is raised and (2) Forces in operation when reed orifice is closed.

First case

Reed raised

Fig I



There is a passage for the escape of air between the reed and its bed as shown by arrow-head — and the moment the weight W ~~[illegible]~~ commences to act a current of air passes through the orifice. But so long as a current passes along the under side of the reed the atmosphere is prevented from ~~[illegible]~~ pressing on the under side of the reed ~~[illegible]~~ i.e.

$$\therefore M = P + P'$$

~~$A + W - (A + W - X)$~~

$$= A + W - (W + X)$$

$$= A - X$$

~~If X is greater than A~~

(1) If X ~~is~~ is greater than A the moving force acts upwards ~~[illegible]~~ + the the aperture between 2 and 6 (Fig 1) is forced to enlarge.

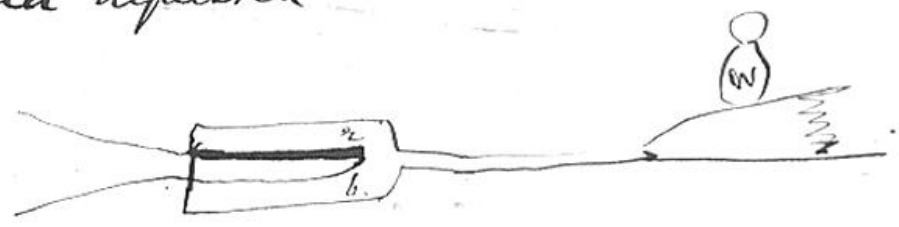
(2) If X is equal to A — the reed is in equilibrium and no motion ensues.

(3) If X is less than A the reed is forced downwards until the orifice is closed and the ~~[illegible]~~ escape of air prevented.

Let x be less than A and consider effect when reed orifice is closed.

Second Case

Reed depressed



There is no escape of air and the atmospheric pressure acts upon under side of reed as well as upon the upper side. The moving force is therefore: —

$$M = P + P'$$

$$= A + W - \{A + (W + x)\}$$

$$= -x$$

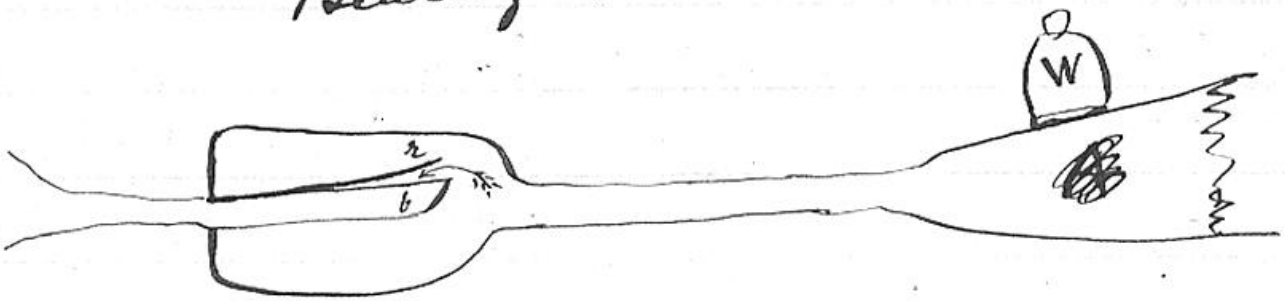
(1) If x is a plus quantity $M = -x$ and acts upwards tending to open aperture

(2) If $x = 0$ The reed remains in equilibrium

(3) If x is a minus quantity $M = x$ and the reed is pressed downwards against its bed.

August 30th 1878. Case of reeds considered again.

Beating reeds.



Definitions. r Reed. b bed of reed. W weight placed upon air-bag.

A. atmospheric pressure acting upon reed.
w. atmospheric pressure ~~acting~~ upon reed due to weight W.
S. ~~upward acting~~ Spring of the reed — tending to ~~keep~~ keep reed raised away from ~~its~~ its bed — b —

$$M = P + P'$$

1st Case. Reed raised. ~~P = A + w P' = (A + S)~~

Owing to escape of air between r & b — the atmospheric pressure is prevented from reaching the under side of reed.

Thus ~~M = A + w + (- S)~~

$$M = A + w - S$$

Hence (1) $S > (A+w)$ Then M is an upward force tending to raise reed

(2) $S = (A+w)$ Then $M = 0$ & reed is in equilibrium

(3) $S < (A+w)$ Then M is a downward force tending to close the aperture between r & b (fig 1)

Let S be less than (A+w) and let the reed be shut down against its bed. Then consider 2nd case.

2nd Case. Reed (r) in contact with its bed (b).

As the escape of air between r & b is prevented the atmospheric pressure is exerted upon the under side of the reed (r) and,

$$M = A + w - (A + S)$$
$$= w - S$$

Hence (1) If $S > w$ then M is an upward force tending to separate r & b

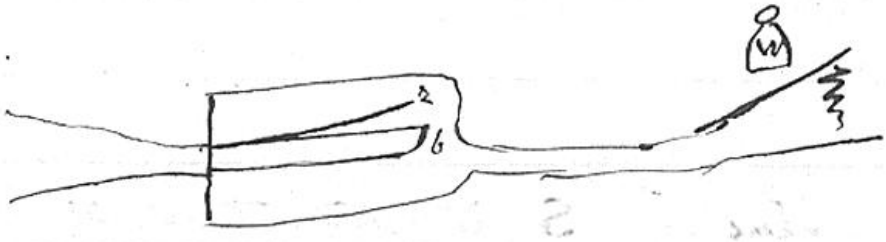
(2) If $S = w$ then $M = 0$ & the reed is in equilibrium.

(3) If $S < w$ then M is a downward force resisting the separation of r & b.

Thus if S is greater than w and less than A+w the reed r will be thrown into vibration and the vibration will be due to the alternate absence & presence of atmospherical pressure on the under side of the reed.

The above investigation satisfies me that I have arrived at the true explanation of the vibration of reeds and the above is a qualitative analysis of the effects produced. Can we not prove the matter by making a quantitative analysis.

Given a reed whose upward spring when closed exceeds w but is less than a + w..



Now before applying W. The reed has attained a position of equilibrium. The spring of the reed may be considered as inoperative. If we force 2 down towards b we find that the force S has a value dependent upon the position of 2. This value is zero at the point of highest elevation and reaches a maximum when the reed touches its bed (b).

Before the weight W is placed in position the force S may be considered as non-existent — and the ~~reed is acted upwards + downwards~~ atmospheric pressure is the same above and below the reed.

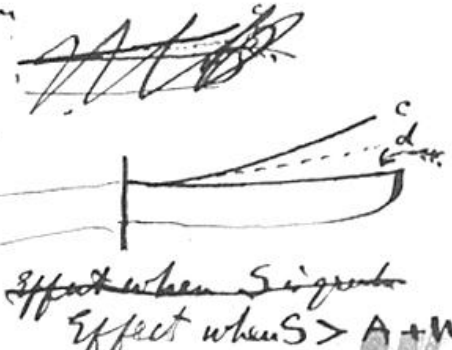
Now place the weight in position.

The downward pressure on the reed is increased and the upward pressure diminished. As the reed moves downward, the upward force S begins to come into play. During the motion of the reed the downward pressure continues uniform — while the upward pressure gradually increases.

Were the reed free to move far enough it would move downwards until the upward pressure of S had become equal to the downward pressure (a+w) and there after a few oscillations it would settle into a position of equilibrium.

Supposing then S to be greater than (a+w) the reed would have two calculable points of equilibrium — one its position of rest when the weight on the air-bag is inoperative and the other its position of rest when the weight acts. In the following illustration c + d are the two points of equilibrium.

Before weight acts reed is in position c.
When weight acts air goes in direction of arrowhead and reed takes position d.



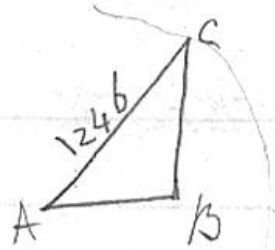
~~Effect when S is greater~~
Effect when S > A+W

Exercise I page 45

Given Hypot. 1246

. Angle A 25°-30'

Angle B 90



Found Angle C = 90° − 25°-30' = 64°30'

To Find side BC. Rad : Sin A = 1246 : BC

Log. Rad	=	10
Log. Sin 25°.30'	=	9.633984
Log. 1246	=	3.095518
Log BC	=	2.729502
BC	=	536.45

Sept. 4th 1878 Plan for School-work.

10.00

Recess 10.50 50

11.00 45

Recess 11.45 35

12.15 45

12.50

1.00

Home 1.45

1 Drill 10 — 10.15 (Drawing)

Voice ~~Voice~~ 10.15 — 10.20

V.S. + Sounds 10.20 to 10.50

~~Object Lesson — 10.20 — 10.50~~ pencil action.

Recess for 10 minutes

2 Drill + voice 11.00 — to 11.10

V.S. + Sounds 11.10 to 11.25

Object Lesson 11.25 to 11.45 (Jessie)

Recess for half an hour.

3 12.15 to

4

Junior Class

I Drill & Voice 10.00 10.40

artic. 10.10 – 10.20

Mental Develop. 10.20 – 10.40

artic. 10.40 – 10.50

50
10 2/45 40
22 Recess 10 minutes

II Drill & Voice 11.00 – 11.05

artic. 11.5 – 11.15

Ment. Dev. 11.15 – 11.35

Artic. 11.35 – 11.45

Recess half-an-hour 11.2.50

III Drill & Voice 12.15 – 12.20

Individ { Artic. 12.20 – 12.35

{ Mental Develop. 12.35 – 12.50

Recess 10 minutes

IV Drill & Voice 1.00 – 1.10

Artic 1.10 – 1.20

Mental Dev. 1.20 – 1.40

Artic. 1.40 – 1.50

(Littlones go home)

Senior class.

9.30 & 10 — Articulation. ag/b

I Drill & voice - 10.00 - 10.10 (ag/b)

~~Arithmetic~~ ~~10.00 - 10.20~~

~~Description~~

Mental Develop. 10.10 — 10.40 } Mod. T.

Articulation 10.40 — 10.50 }

II Drill & voice 11.00 — 11.05 (Mod. T.)

Mental Develop. 11.05 — 11.35 } ag/b

Artic. 11.35 — 11.45 }

Recess half an hour

III ~~Drill & voice 12.15 — 12.20~~

Writing from 12.15 to 10 o'clock.

2.45 - 2.01

IV Drill & voice — 1.00 - - 1.10 (Mod. T.)

Artic. 1.10 — 1.20

Ment. Devel. 1.20 — 1.50

Recess for 10 minutes

Articulation 2.00 — 2.30

Log 3708 = 3·569140

Log. 11488 = 4·059942

302·4

4·060244 4

9025 = 95·5447

42·3

955·4893

Log 621547 = ?

Log 6215 = ·7934·41

Fibo ~~f~~

28

4·9

Log. 621547 = 5·7934739

Log x = Log 623 + Log 861 − Log 1000.

Log 623 = 2·794488

Log 861 = 2·935003

Log 1000 = 3·000000

536

2·729491 = Log 536·4.

489

·2

$(1246)^2 - (536.4)^2 =$

R : Sin 64°.30' :: 1246 : y

.90259

100000 : 90259 :: 1246 : y

y - Log 1246 = 3.095518
Log 90259 = 4.955489
Log 100000 = 5.000000

Log y = 3.050007
050766 = 1124
241
231.6
6

~~y =~~

05076 6
231.6
050997.6

$y^2 = (1124.6)^2 =$

$x^2 = (536.4)^2$ = ~~28 77 24 9 6~~

$x^2 + y^2 = (1246)^2$ = ~~1 55 28 16.00~~

$x^2 = (1124.6)^2$

$y^2 = (536.4)^2$

$x^2 + y^2 = (1246)^2$

By Log. (Twice the Logs).

Log 1124.6 = 3.050997.6

Log 536.4 =

Log 1246 =

Log 1124.6 = 3.051007 ✓

Log 536.4 = 2.729491

Log 1246 = 3.095518

Double the Logs Numbers

6.102014 = 1264780

5.458982 = 287728

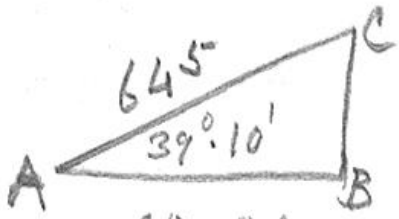
6.191036 = 1552870

1553508

102014
104747 = 1264[7]8
267
240
270
274

458982
8940 = 287728
42
30
120
120.8

191036
190892 = 1552[8]7
244
224
200
196



90.00

$A = 39^\circ.10'$

$C = 50.50'$

$A = 39^\circ.10'$

$C = 50^\circ.50'$

$CB = 407.368$

Rad : Sin 39.10 :: 645 : CB $AB = 500.077$

Rad : Cos :: 645 : AB

Log CB Rad = 10.

Log Sin 39.10 = 9.800427

Log 645 = 2.809560

Log CB = 2.609987

1099.14 = 407.368

73

64.2

88

85.6

CB =

CB = 407366

Log Rad 10.

Log Cos. 9.889477

Log Bas 2.809560

Log AB = 2.699037

699037

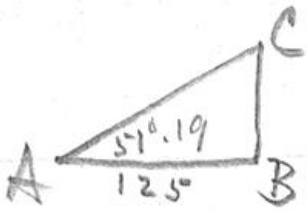
698970 = 500.077

67

60.9

61

60.9



Given $AB = 125$
& $A = 51°.19'$

Make AB = Rad.
Then AC = Sec. $51°.19'$
and BC = Tan. $51°.19'$

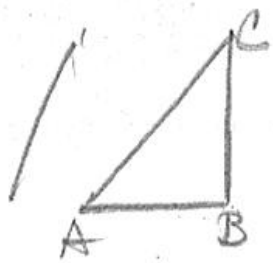
~~$CB = 125 \times$ Tan. $51°.19$~~

Log Rad = 10.
Log Sec. $51°.19'$ = 10.204109
Log Tan. $51°.19'$ = 10.096545
Log 125 = 2.096910

Log AC = 2.301019
Log BC = 2.193455

2.301019
300813 = 199.9949 = AC
206
195.3
107
106

2.193455
193403 = 156.1186 = BC
52
27.8
242
250



AB = 180
A = 62° 40' } Given

To find BC

Log Rad = 10.
Log Sine A = 10.286614
Log AB = 2.255273
2.541887
541829
58
50
80
75
50
50

BC = 348.2464

To find AC

Rad = 10
Log Sec. = 10.338030
Log AB = 2.255273
2.593303
3286
17
11.1
59
55.5
33.3

AC = 392.0153

Given $AC = 645^-$, $AB = 500$

To find BC.

$AC^2 - AB^2 = BC^2$

$(645^-)^2 = 416025^-$

$(500)^2 = 250000$

$\sqrt{166025^-} = 407.8.?$

By Logarithms

Log $166025^- = 5.$

$1660 = 220108$

$2 \quad 52.2$

$5^- \quad 13.05^-$

$2 \overline{)5^- \cdot 220173.25^-}$

$2.610086 - 625^-$

$610021 =$ (407.46133

65^-6

64.2

14

10.7

35^-5

32.1

34

32.1

Finding A B Rad.

Sec of A : Rad :: AC : AB

Log Rad = 10.

Log AC = 2.809560

Log AB = 2.698970

Log Sec A = 10.110590

1105·90

1105·23 = 39°·10'·39"

171) 67000 (39

513

1570

1539

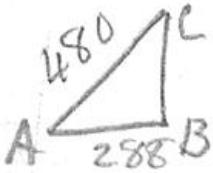
31

2·584330 — 85"

584331

384

A = 39° 10' 39"



A = 53° 7' 48"

C = 36° 52' 12"

Sec A : Rad :: AC : AB CB = 384

Log Rad 10. ←

Log AC 2·681241

Log AB 2·459392

Log Sec A 10·221849

221713

$AC^2 = (480)^2 = 230400$

$AB^2 = (288)^2 = 82944$

$CB = \sqrt{147456}$

90 a c u CB

= 53°·7'·48"

28) 13600 (485) 36°·52'·12"

112

240

232

224

16

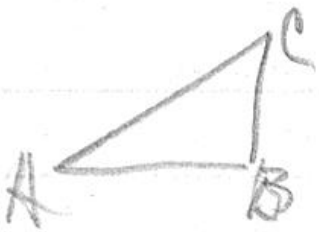
1474 = 168497

5 147

6 17·7

2 5·168661·7

2·384330·85



Given	Found
AB = 360	A = 53° 7' 48"
BC = 270	C = 36° 52' 12"
	AC = 450

$$AC = \sqrt{AB^2 + BC^2}$$

$AB^2 = (360)^2 = 129600$

$BC^2 = (270)^2 = 72900$

$\log 202500 = 2 \quad 5.306425$

$\log AC = 2.653212$

$\log 450 = 2.653213$

$$AC = 450$$

In $\triangle ABC$

$\sin A : R :: 360 : 450$

$$\sin A = \frac{R \times 360}{450}$$

$\log R = 10$

$\log 360 = 2.556303$

$\log 450 = 2.653213$

$\log \sin A = 9.903090$

9.903014 $\quad 53° 7' 48"$

$158 \overline{)7600(48}$

632

1280

1264

16

Given

$AB = 467$

$BC = 389$

Found

$AC = 607 \cdot 792$

$A = 39^\circ\ 47'\ 36''.7$

$C = 50^\circ\ 12'\ 23''.3$

$AB^2 = 218089$

$BC^2 = 151321$

$AC^2 = 369410$

$\text{Log} \cdot AC^2 = 5 \cdot 567497$

$\text{Log } AC = 2 \cdot 783754 - 5$

$AC = 607 \cdot 792$

$\text{Tan } A : R :: CB : AB$

$\text{Tan } A = \dfrac{R \times CB}{AB}$

$\text{Log } R = 10$

$\text{Log } CB = 2 \cdot 589950$

$\text{Log } AB = 2 \cdot 669317$

$\text{Log Tan } A = 9 \cdot 920633$

$9 \cdot 920476 = 39^\circ\ 47'\ 36''.7 = A$

$428)\ 1570,0\ (36.7$

1284

2860

2568

2920

2996

Given

$AB = 530$

$BC = 670$

Found

$AC = 854.282$

$A = 51° 39' 15''.9$

$C = 38° 20' 44''.1$

$AB^2 = 280900$

$BC^2 = 448900$

$AC^2 = 729800$

$\text{Log } AC^2 = 5.863204$

$\text{Log } AC = 2.931602$

$AC = 931560 = 854.282$

42

40.8

12

10.2

$\text{Tan } A = \dfrac{R \times BC}{AB}$

$\text{Log } R = 10$

$\text{Log } BC = 2.826075$

$\text{Log } AB = 2.724276$

$\text{Log Tan } A = 10.101799$

$10.101730 = 51° 39' 15''.9$

433) 6900 (15.9

433

2570

2165

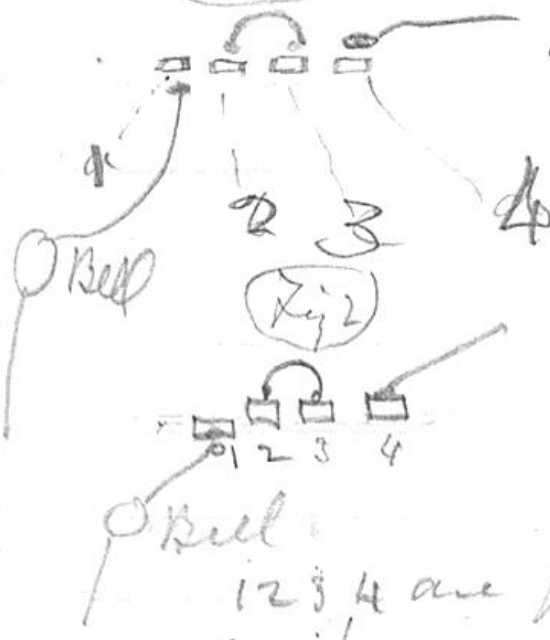
405

3897

153

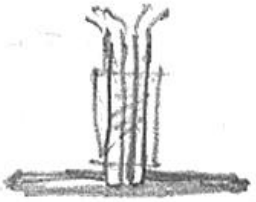
Sept. 20th. 1878 For telephonic circuits where a number of subscribers are on the same circuit — we want an arrangement whereby ~~A can ring the bell~~ any one house can ring up any other house upon the circuit without ~~interfering~~ calling up intermediate, disturbing the others. Why not have a sort of puzzle-lock connection with bell — so that bell won't ring until puzzle lock is set to a certain number the number of the house.

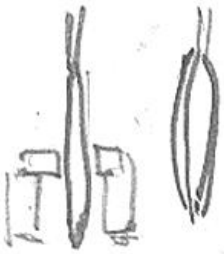
Fig 1

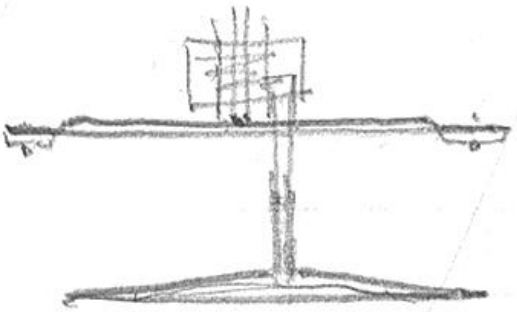


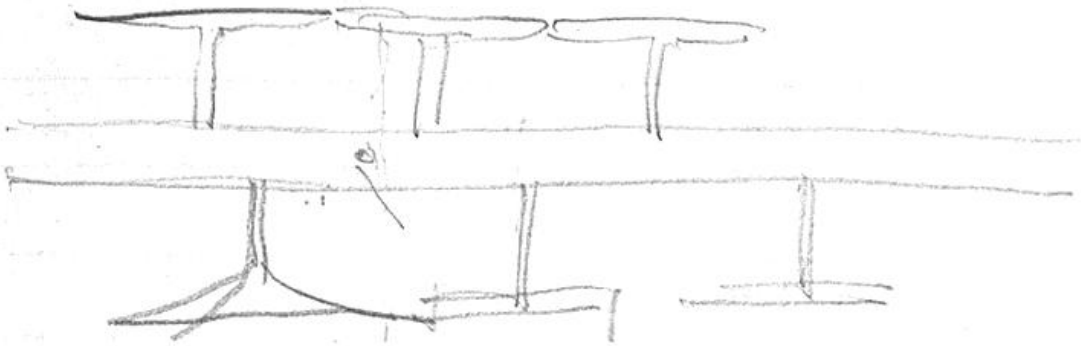
Let 1234 be the ends of levers that could be moved severally by an electro-magnet either downwards or upwards and which levers retain the positions in which they are placed. Then when 1234 are placed as in Fig 2 the bell can be rung — but if the levers 1234 are diff. arranged bell-circuit is broken.

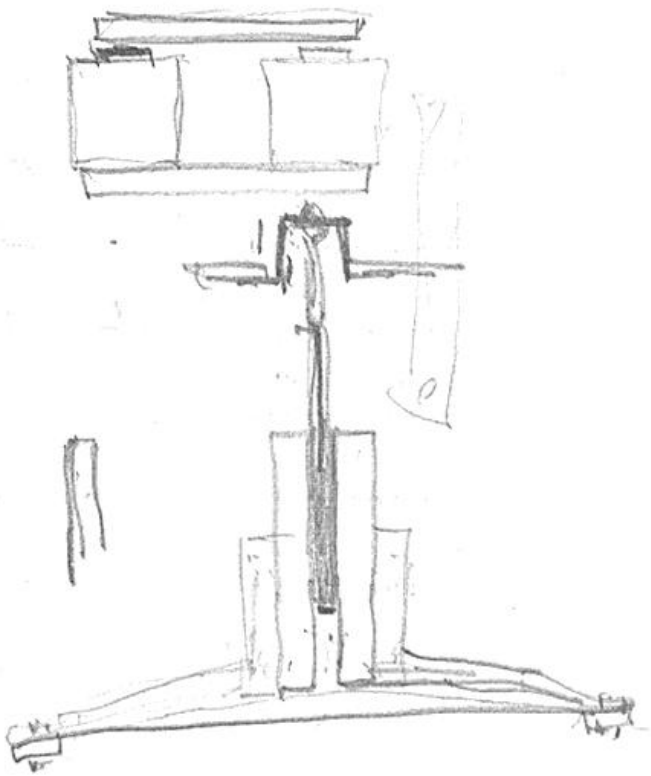
Fig 2



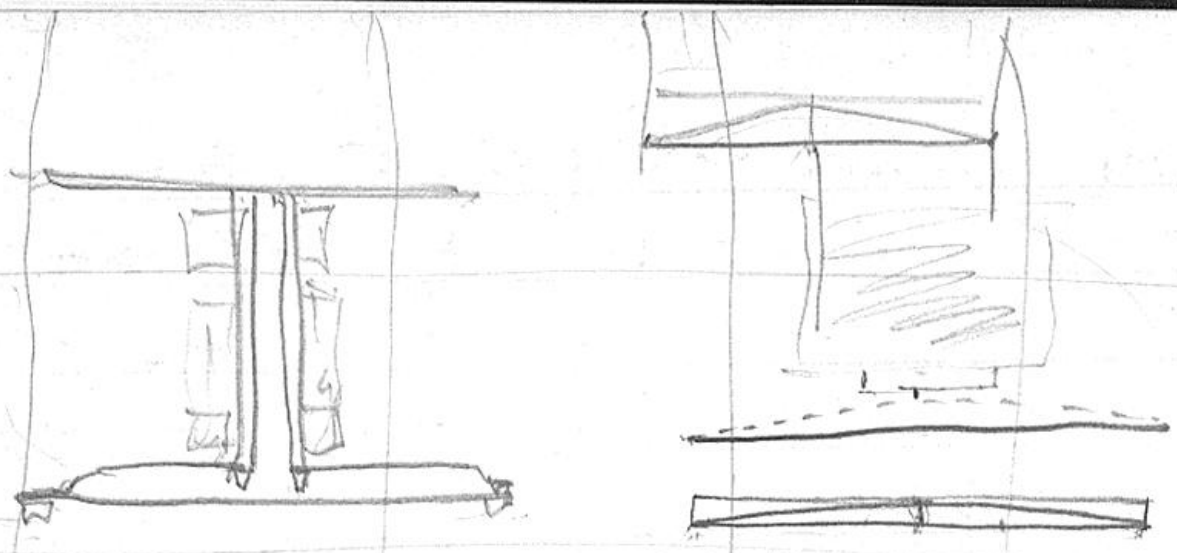








61
8 36 inches
4 cubic inches



Suppose a circular plate 6 inches offering 36 square inches of surface to have its centre moved one eighth of an inch towards magnet or the volume of water displaced would be slightly more than 1/2 of 1/8 of 36 cubic inches. That is equivalent to the displacement of 2.25 cubic inches of water.

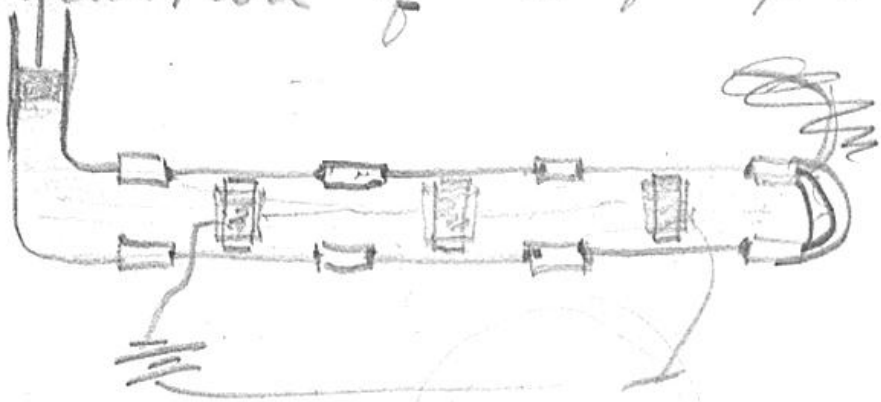
$\frac{1}{2} \times \frac{1}{4} \times \frac{36}{1} \quad 4/9 \quad 2.25$

~~Let thus this paragraph cut as a piston.~~

This would give a stroke of 2.25 inches to a piston placed in a pipe whose cross-

section was equivalent to 1 sq. inch.

This plan evidently will enable us to obtain a stroke of any desired length and any power by a combination of diaphragms.



Let

Place a number of magnets in pipe whose side contains a number of metallic diaphragms. You get the combined effect upon the piston in pipe.

It is certainly the case that enormous power is generated within a short distance from the pole of an electro magnet. Let us then ~~fine ourselves to~~ make the maximum distances of the diaphragms from the magnets 1/16 inch. Enormous force would be exerted on the plate. Let us calculate how many diaphragms of ten inches diameter would be required

to produce a stroke of four inches with a piston whose area is four square inches.

Area of diaphragm = 36 Sq. inches.
Height of movement = 1/16 in.

$$\text{Displacement} = \frac{1}{8} \times \frac{1}{16} \times \frac{36}{1} = 1.125 \text{ (Cub. inch)}$$

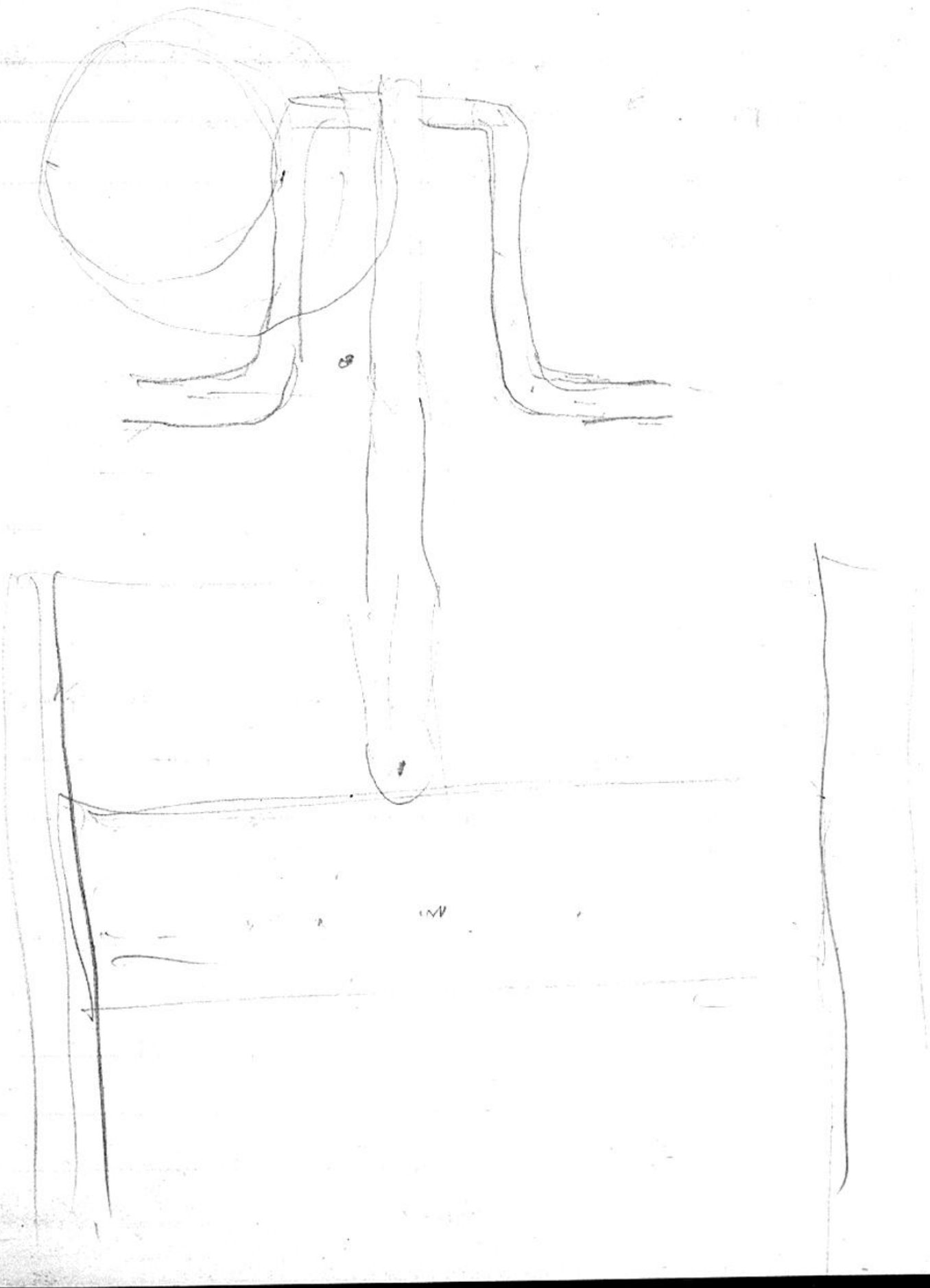
Each diaphragm displaces 1.125 Cubic inches

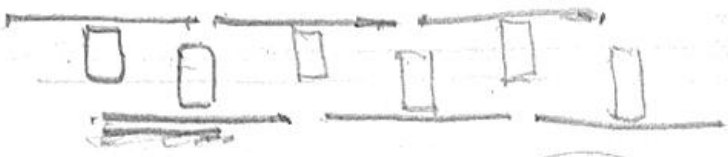
Displacement required to produce required motion of piston = 4 × 4 Cubic inches = 16 Cub. inch
Hence number of diaphragms required is

16 ÷ 1.125

$$\begin{array}{r} 1125)\overline{16000}(14 \\ 1125 \\ \hline 4750 \\ 4500 \\ \hline 250 \end{array}$$

16 diaphragms + eight magnets would produce the required displacement





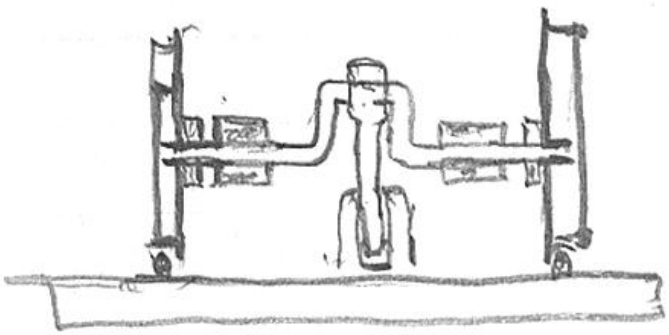
8 diaphragms

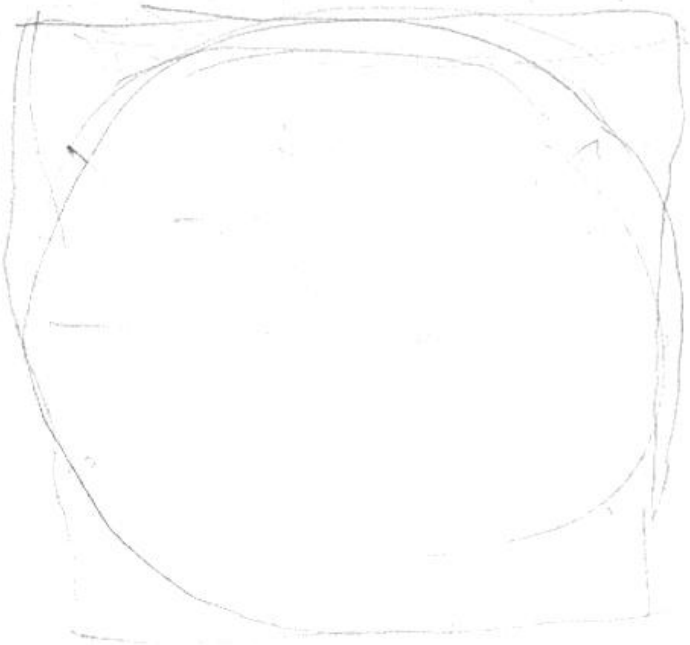
$(8 \times 6) + 8 =$ 56 inches or four feet

By the eye why not make the diaphragms the wheels of your electro-magnetic engine ~~[illegible]~~ and the magnet the axle & bent axle ~~[illegible]~~

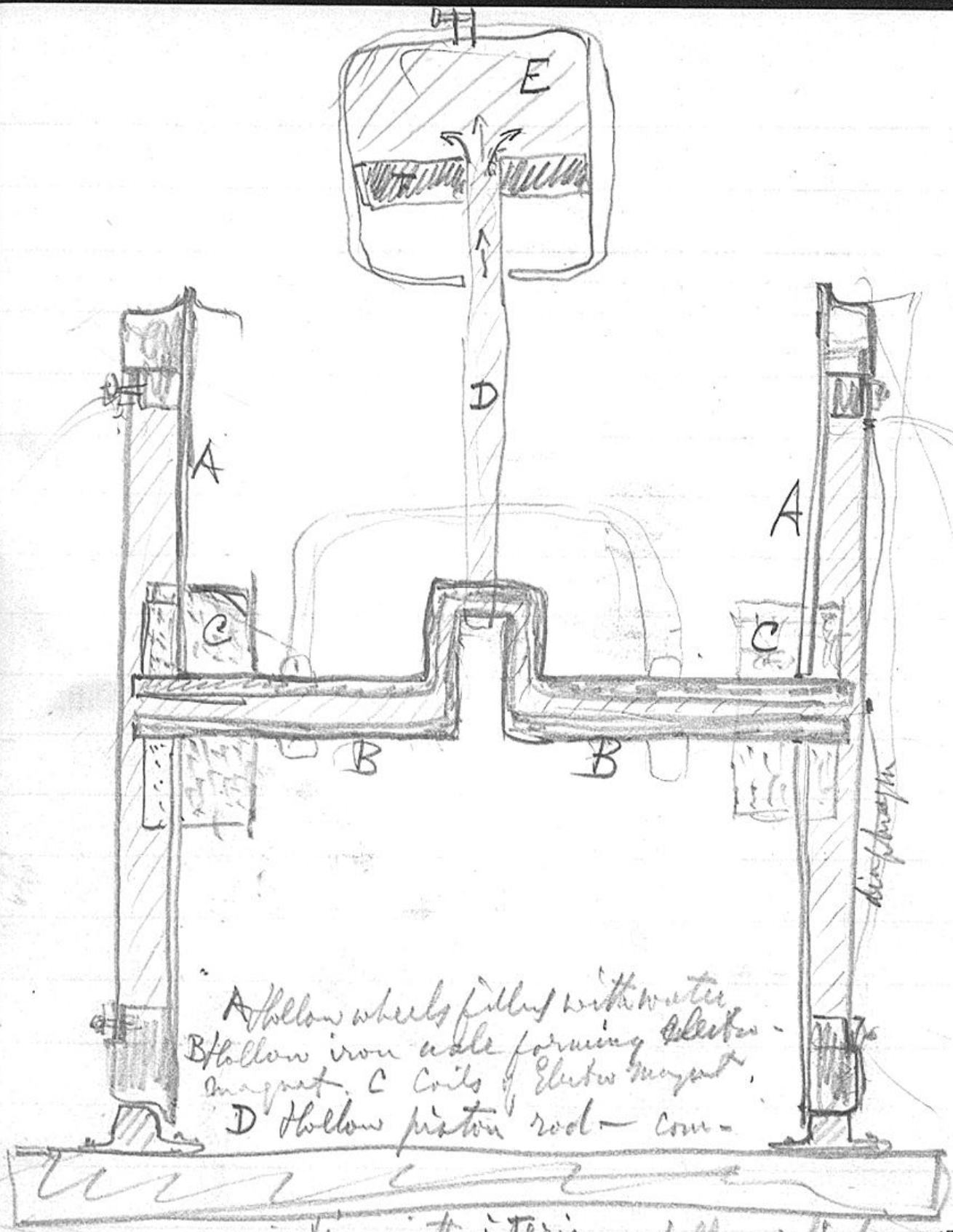
Splendid idea ! !

See Mountaineer.

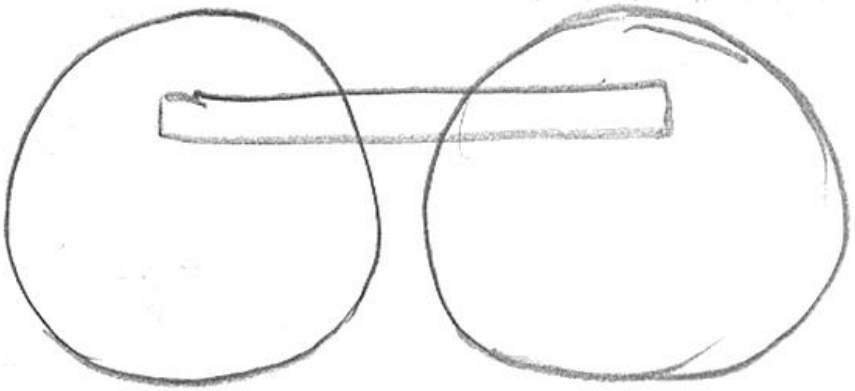


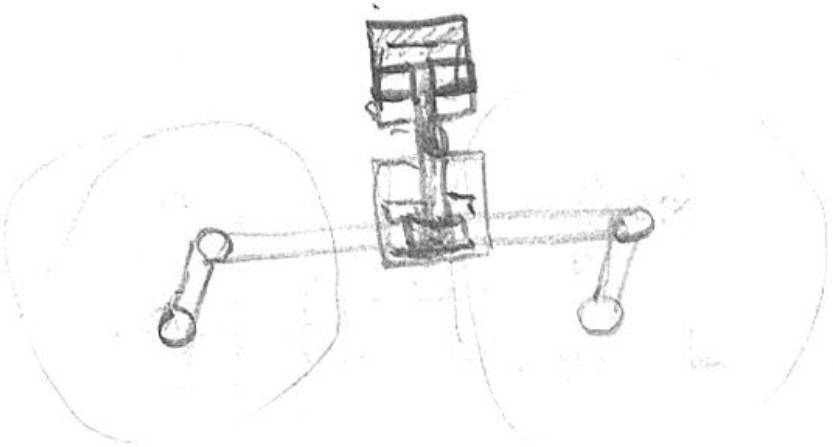


2



A Hollow wheels filled with water
B Hollow iron axle forming electro-
magnet. C Coils of Electro magnet.
D Hollow piston rod — com-
municating with interior of hollow cylinder E.
When current passes magnets attract diaphragms ~~K~~ and water is forced out of wheels through the axle & piston rod into the chamber E and thus the piston F is ~~retracted~~ pushed out. When the current ceases the diaphragms spring





$\frac{86}{144}$ $\frac{4}{4}$ $\frac{2}{1}$ sq. inches

$\frac{16}{64}$ $\frac{4}{4}$

$\frac{1}{2} \times \frac{1}{16} \times \frac{32}{1} \div 2$ sq. inches

$\frac{1}{2}$ of $\frac{1}{16}$

$\frac{1}{32}$

back to their own elasticity. Water is dropped into chamber E and piston moved out of cylinder.

Diameter of wheels .. four feet

or rather say (48 × 48) sq. inches.

48 / 48 / 384 — 6 3 1

192 / 2304 Say 2000 sq. inches each diaphragm

The four wheels would therefore have 8000 sq. inches of diaphragm. Let them be moved 1/16th of an inch.

Then displacement = $\frac{1}{8} \times \frac{1}{16} \times$ ~~8000~~ 500 cubic inches

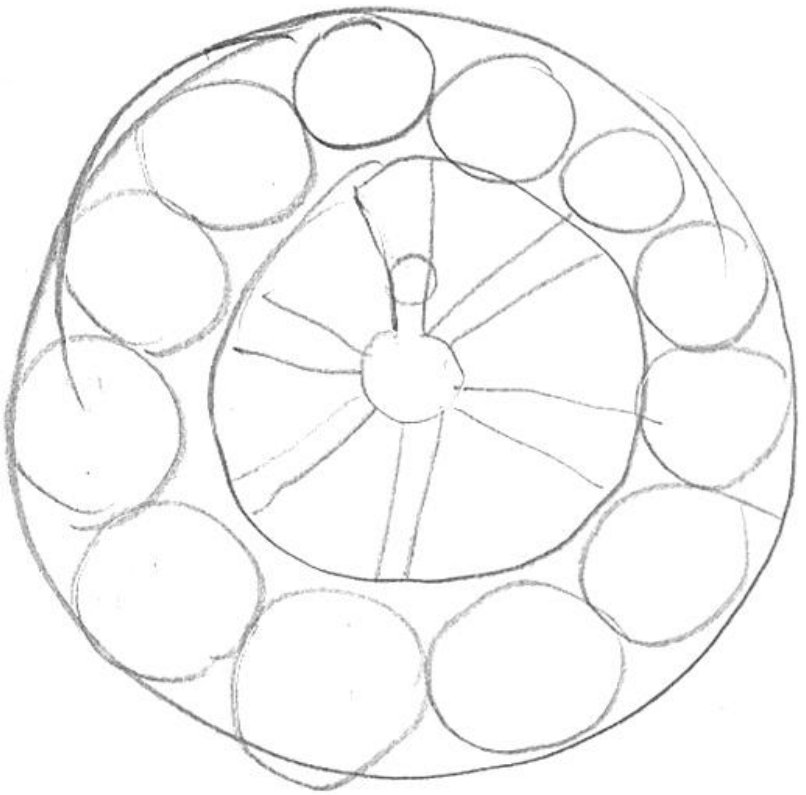
~~250 cubic inches of displace~~

250 cubic inches of water would therefore be displaced at every stroke.

~~Suppose our piston to have one square foot of surface = 144 sq. inches~~

~~Then 250~~

Let the piston have a stroke of 5 inches then the internal diameter of water cylinder or of piston will be 250 ÷ 5 sq. inches 50 sq. inches and the diameter would be about 8 inches.



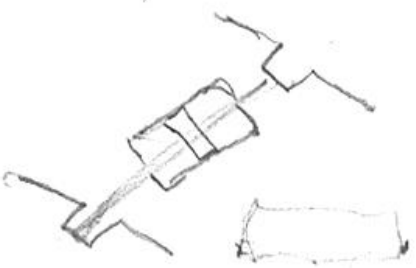
$\frac{4}{16}$

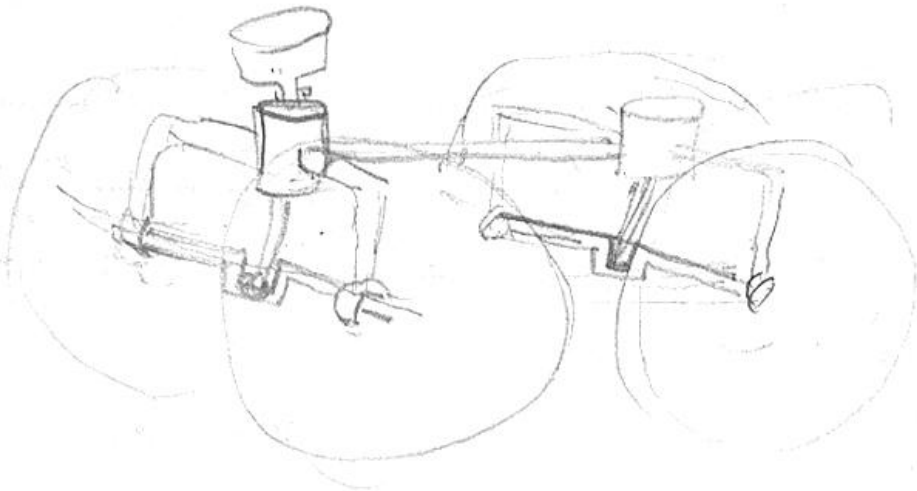
$\frac{1}{16} \times \frac{4}{1} = \frac{1}{2}$

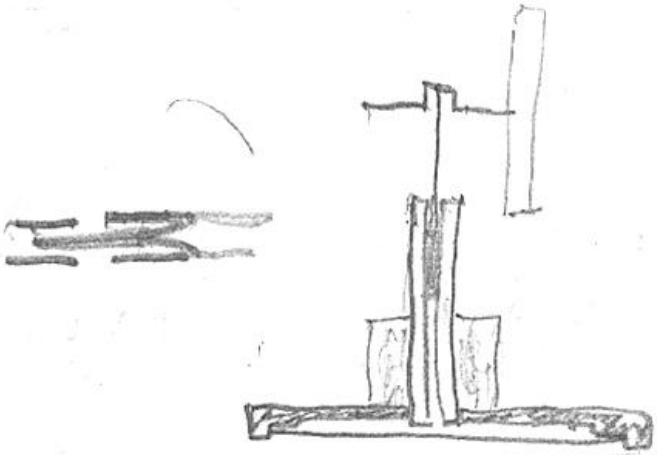
2

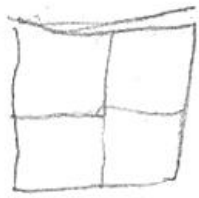
$\frac{1}{16}$

16



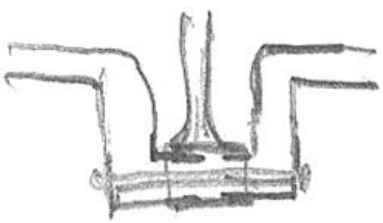






$\frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$

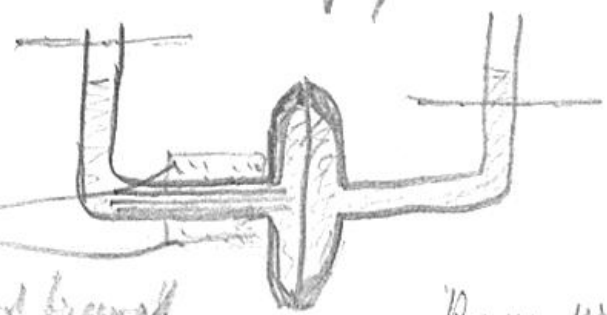
$\frac{1}{2} \times \frac{1}{16} \times \frac{16}{1} = \frac{1}{2}$ cal in



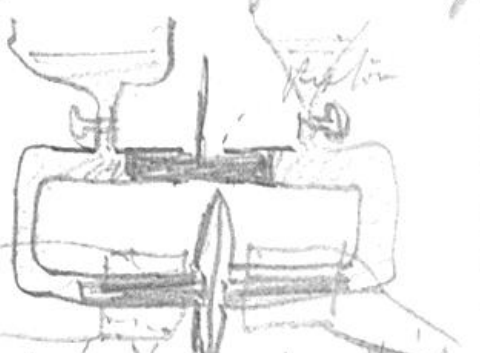
Sunday Sept 29th (?) 1878

The pressure of the water will have a tendency to cause the diaphragm to bulge outwards and thus to go from magnet. Even if the diaphragm be retained in position by a screw still the magnet must overcome the whole pressure due to the water before moving the piston.

Have water on both sides of the diaphragm so as to equalize pressure on the two sides when magnet is not moving. Have following arrangement made of glass.



Piston



Fill left hand branch with iron wire and coil outside glass pipe.

Pour water into both tubes till it is of equal height in both

Sunday Sept. 29th 1878

We left Goswick Friday morning just before leaving Elsie rolled off Roger ~~on~~ out the floor. We were all much frightened as she struck her head on floor. However it turned out she fell on her face and it is only her nose that is hurt. The Doctor said it was no matter and we might travel with her with perfect safety. Reached Edinburgh Friday afternoon ~~[illegible]~~

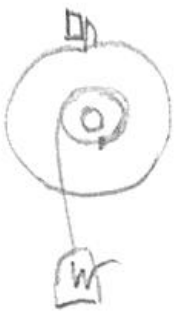
Sunday Sept. 29th 1878

Simple Hotel Indicator a desideratum. My experience of automatic Indicator — is that it will be expensive if like Model made by Mr Bailey. A Simple Indicator should be a most inexpensive contrivance.

Idea noted upon a Hand Indicator for Hotels (June 10th 1878).

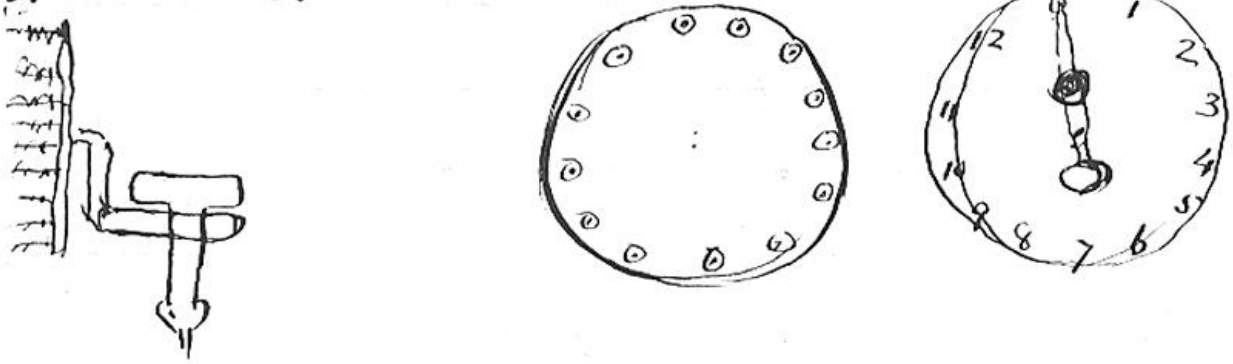
Make hand indicator fly back to Zero by weight or spring.

or

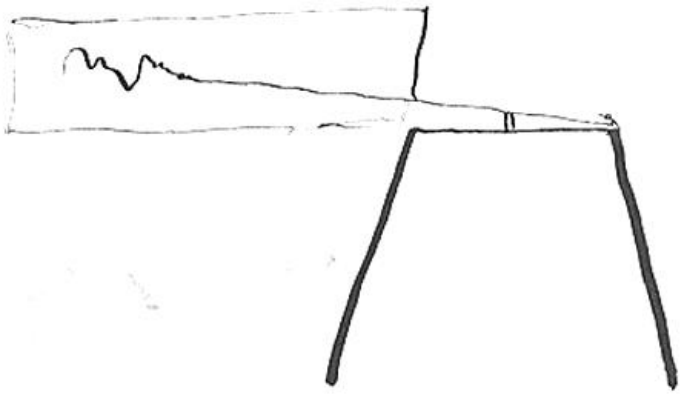


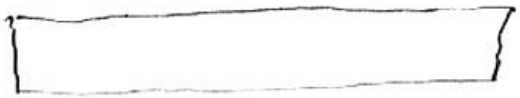
October 4th 1878

Oct. 5th 1878



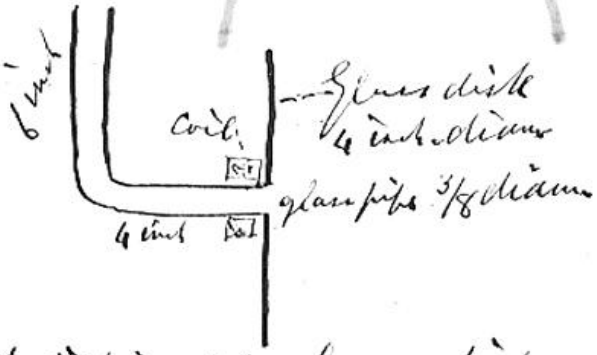
Oct 5th. 1878 Lent Wm Brown
Amer. Telegph. No 349, 391—





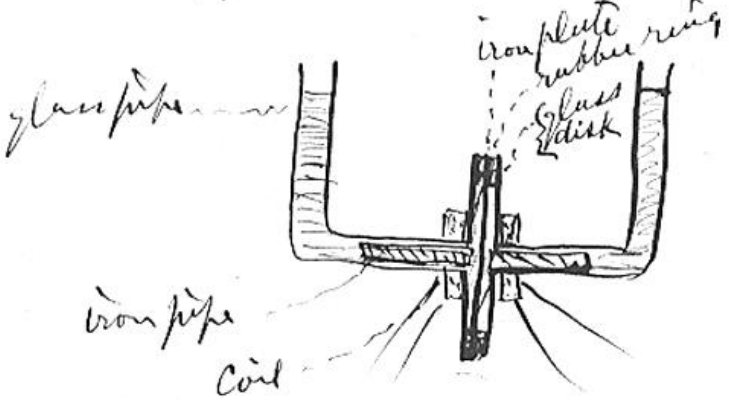
October 6th 1878 —

Oct. 14th 1878 Mr Scott & I have following apparatus made for me today.

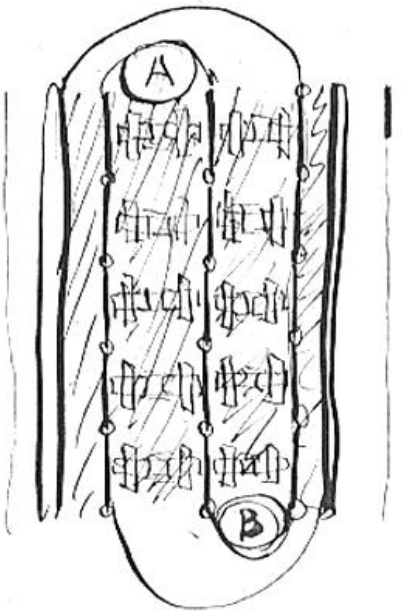


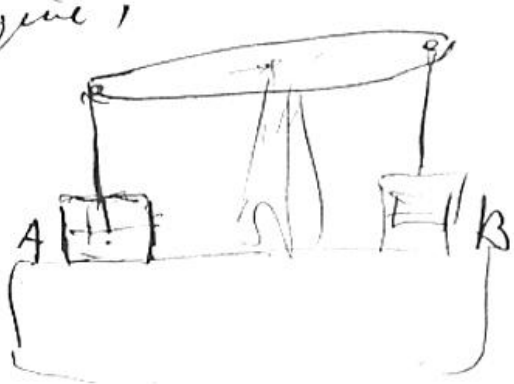
Iron pipe to fit inside glass pipe. 3 inches long by ¼ diam.

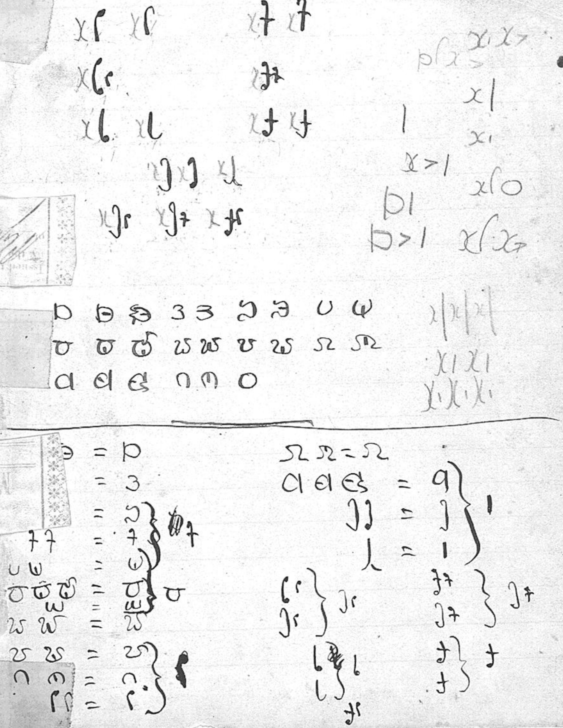
Whole apparatus to be arranged as follows



Electro-magnetic Engine







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